

TEACHER'S GUIDE
to
Learning Science, Parts I, II & III
(Textbooks for Classes VI-VIII)

Based on
Integrated Science Curriculum

Prepared at
Department of Education in Science and
Mathematics



एन सी ई आर टी
NCERT

राष्ट्रीय शैक्षिक अनुसंधान और प्रशिक्षण परिषद
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FOREWORD

The National Council of Educational Research and Training developed the Integrated Science Curriculum for Classes VI-VIII as an alternative to the discipline-wise courses. It was planned to develop a complete curricular package, which included syllabus, textbooks, teacher's guides, test items and kit, for an effective implementation of the curriculum.

This teacher's guide is a part of the total package that has been developed. It was prepared and refined through two workshops attended by subject experts, teacher educators and classroom teachers. The guide is meant to be used in relation to the textbooks, *Learning Science* Parts I, II and III, prescribed for Classes VI, VII and VIII, respectively. The effort has been to help classroom teachers to plan their lessons and organise pupil activities and teacher demonstrations, including the field trips, thus helping in the strengthening of teaching-learning situations. Additional information on content and methodology, wherever necessary, has also been included.

The Council is grateful to the resource persons and the participants of the workshops for their constructive criticism and suggestions which have helped in effecting improvements in the material at various stages of its development. Their names are indicated separately at the end of the text.

I am thankful to Dr. B. Ganguly, Shri K. J. Khurana, Dr. K. M. Pant, Dr. Ravi Bhatia, Dr. J. S. Gill, and Dr. (Mrs.) S. B. Mallik, all of the Department of Education in Science and Mathematics, for their contribution to the development and editing of the material. My special thanks are due to Shri K. J. Khurana and Dr. J. S. Gill (Coordinator) for the final editing, making the manuscript press-worthy and seeing it through the press.

I hope that teachers will find this guidance material useful and will offer their suggestions for its further improvement.

T. N. DHAR
Joint Director

New Delhi
November 1982

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INTRODUCTION

At the middle school level (age group 11-14), science was introduced earlier as disciplinewise curriculum and was taught as separate subjects like Physics, Chemistry and Biology. National Council of Educational Research and Training, developed syllabuses, text books, teachers' guide, kits, kit guides and audio visual aids for the teaching of these subjects.

The approach paper—"Curriculum for the Ten year School"—A Framework, drawn by the NCERT in 1975 has recommended the development of an Intergrated Science Curriculum, for the middle school level (age group 11-14). The following general objectives were kept in view while framing the intergrated science curriculum :

1. To emphasise the relevance of science to daily life.
2. To develop scientific attitude in pupil.
3. To create an environment conducive to greater reliance on the use of principles and practices of science.
4. To acquaint the pupil with various natural phenomena.
5. To develop an outlook which emphasises the unity of methods employed in different diciplines of science.
6. To emphasise the experimental nature of science.

Though the general objectives of the present course resemble that of disciplinewise curriculum, yet the approach and expected learning outcome are completely different. The details of the approach, presentation and other particulars about the intergrated science curriculum are given in Appendix-1.

The course was developed in stages and has been in use in some schools all over the country. The classroom teachers who took part in

the development of textbooks and who are using the material, have repeatedly expressed the need of a teachers' guide for meaningful and effective implementation of the course. Accordingly the departmental team undertook this work with the help of classroom teachers, subject experts and the science education specialists from different states.

Format of the Teachers' Guide

The materials have been presented chapterwise in the teachers' guide in the following format :

1. **OVERVIEW :** It gives the theme of the chapter, highlighting the previous knowledge as well as the link with the subsequent chapters.
2. **LEARNING OUTCOME :** The minimum expected learning by the child is presented here. It includes the following.

2.1. **Key terms :—**The important terms, which the students are expected to learn while studying the chapter are listed in the chronological order.

2.2. **Major ideas and explanatory notes :—**The important ideas to be conveyed to the students through this chapter, together with hints for elaboration wherever necessary are given in this section.

2.3. **Activities :—**The suggested activities including those in the textbook are either to be demonstrated (D) by the teacher or to be done by student (S). The items required and skills to be developed, along with hints, are mentioned for each activity. Suggestions have been offered for improvisation of useful equipment and utilisation of the local resources. Some relevant comments for information of teachers are also included.

2.4. **Relevance to daily life :—**Ideas for linking the topic to the real life and the immediate surrounding of the child have been emphasised.

3. **EVALUATION :** A few examples have been given to test the student's achievement. It is hoped that teachers will use their own experiences for devising suitable questions to determine how far the expected learning outcome has been fulfilled. As the present course stresses on the fulfilment of affective domain objectives, the teachers should not be satisfied by testing the cognitive objectives only. It would be important to ascertain :—

- (a) Are the students becoming interested and curious ?
- (b) Have the students developed the courage of asking questions on the topics which they do not understand ?
- (c) Have the students developed the habit of collecting and analysing data before taking any decision ?
- (d) Have the students been able to correlate the science learnt in the classroom, with the things and occurrences in the environment?

4. **REFERENCE MATERIALS :** It includes the suggestions for books, periodicals, magazines and some other interesting materials for further reading. The textbook is not enough to meet the curiosity of the child, it becomes necessary to expose them to a variety of learning materials. Such reading materials are expected to strengthen the knowledge of both the students and the teachers. The Organisations like National Book Trust, Indian Council Agricultural Research, Indian Council of Medical Research, National Council of Educational Research and Training are regularly publishing instructional materials of general as well as specialised nature. The teachers may keep contact with such organisations for information about all the future publications released from time to time. The addresses of the organisations are given in Appendix-II

About the use of Teachers' Guide

The present teachers' guide has been developed as a companion of the teacher to help in the teaching. The help does not mean that teachers

will have to follow the material line by line. No attempt has been made to show about the preparation of lesson plan or methodology to be adopted for teaching. The classroom situations being different from school to school, there cannot be any common prescription to be followed in all kinds of situations. With clear understanding of the expected learning outcome of each chapter, a teacher is the best person to use his experience and ingenuity to offer learning experiences to the child. The present attempt aims to help in the development of a clear understanding about each chapter specially the expected learning outcome. The teachers may keep the following points in mind in their classroom teaching of this course with the help of present teachers' guide.

1. Before the commencement of the session, it is necessary to read all the three textbooks and the "Introduction" part of the teachers' guide (together with Appendix-I).

2. Apparent similarity, of the chapter headings with the titles of conventional Physics, Chemistry and Biology, may lead to this erroneous belief that the Integrated Science Course is just an amalgamation of three disciplines which is not true. The topics presented as chapters in this course are selected because these are the things and occurrences in the environment, which all individuals experience. For such experience one need not have to be a physicist, chemist or biologist. The present course has attempted to codify that experience. In each chapter examples have been chosen from both animate and inanimate world and specially to point out its application and relevance to the daily life situations. The teaching of these topics may be done by teachers with any background of science. In that task, as teachers usually do, they may consult different books or other people (including fellow teachers). But in no case an impression should be created in minds of the students that the science is compartmentalised. Science is one and part of the daily life of all individuals-this message must be conveyed to the child.

3. While presenting each topic, examples from the immediate environment have been given top priority and observations of the child have been treated as the nucleus. As examples vary from environment

to environment, the teachers should use their imagination to replace the examples suitably. This gives the teachers a freedom from the rigidity of the textbook and they must utilise this freedom judiciously.

4. The course does not intend to develop any scientific expertise, which is not possible to attain at this age group. What it expects, is to develop a *scientific attitude* or *scientific literacy*. Such attainment means the students will :

- a. understand the nature of scientific knowledge.
- b. understand and apply accurately appropriate science concepts in interacting with his/her environment
- c. apply processes of science in solving daily life problems, making decisions and expanding own understanding of the universe
- d. understand the values that underline science and consciously select to apply them *or not* in interacting with the environment.
- e. understand and appreciate the interaction of science and technology and its social relevance.
- f. develop a richer and satisfying experience to act as a force to extend this education throughout life.
- g. develop numerous manipulative skills required for science and technology.
- h. develop an ability to think on the formal operational level.

In order to achieve the above, the present integrated science curriculum :

- i. stresses on a limited number of concepts which cut across a large number of ideas and are helpful throughout the life of the learner.
- ii. demands active doing than passive receiving
- iii. is linked with the social relevance.
- iv. has laid emphasis on the attainment of values like interest, curiosity, courage, sense of involvement, feeling for others etc,

- v. attempts to fulfil the cognitive objectives for furthering the mature understanding of science in future.

5. Gramming answers and home work in the conventional sense is to be totally discouraged in the teaching of present curriculum. While teaching the teachers must avoid the practice of dictating answers to the questions and also home task which demands help from parents or private tutors. In its place the observational activities or thought provoking projects may be given.

6. It is not necessary to perform all the activities given in the textbook. Teachers will select activities on the basis of his/her school conditions. It is always better to perform a few activities properly than to complete all activities ineffectively. If the teachers feel, they may replace the suggested activities by some other activities especially the ones which will promote the use of locally available items. The composite integrated science kit being developed by NCERT as a part of this course includes materials both for demonstration as well as students activity.

7. S. I. units have not been strictly used in the textbooks. Wherever possible teachers should take proper steps to introduce S. I. units.

8. In order to offer rich learning experiences to the child, the teacher should depend not only on books and magazines but also use the cuttings from the newspapers, information from radio/television talks, exhibitions, excursions by meaningfully linking with science teaching.

CHAPTER 1

MEASUREMENT

1. OVERVIEW

Like observation, measurement is a basic science process which is built in various activities that children perform in daily life and those they perform as a part of the course in science at the school. Some of the games like *Gully-Danda* or cricket involve ideas about estimation and measurement of length, force and time. Moreover, all the children have got some background experience about estimation and measurement of length, capacity and mass through activities at home.

Children have been introduced to the idea of measurement in the primary classes. The teacher may review the elementary ideas of measurement they already know. He may then introduce the methods of measurement and standard units of different quantities like length, weight, time etc. In this chapter approximate methods of measurement of length and volume are also discussed. The need for accuracy of measurement and different standards is also introduced.

2. LEARNING OUTCOME

2.1 Key terms

Length (m, cm, mm, km); Area (m^2); Volume (m^3);
Temperature, $^{\circ}\text{C}$ (Celsius);
Mass (kg, mg, quintal, tonne); Time, (min., h);
Standard scale; Multiples of a unit (deci, kilo);
Unit (standard unit); MKS System;
Sub-multiples of unit (milli, centi);
Internal volume or capacity (litre);
Estimation;

Speed (km. p.h.);
Colloquial measurement

Note: The teacher may also like to introduce terms like 'acre', 'hectare' for area; decimetric, decametre for length, and tonne (t) which is the term for 'metric tonne'.

2.2 Major ideas and explanatory notes

- (i) Different scales are chosen depending upon the objects to be measured.
- (ii) There are standard scales which are universally used in measuring different quantities like length, mass, time, etc.

Note: (a) The kilogram is a unit of mass not of weight but colloquially it is used as a unit of weight also.

(b) The pulse rate of a human being taken as '1 Pulse per second' or one vibration of a second pendulum may also be used as an approximate unit of time when a stopclock or a watch with second's hand is not available.

- (iii) Multiples and sub multiples of standard units are also conveniently used when the quantities to be measured are very large or small respectively.
- (iv) Area is a measure of the surface and is expressed in units of square metres or its multiples or submultiples.
- (v) Volume is a measure of the space occupied by a body and is measured in units of m^3 or its multiples or submultiples.

Note: The holding capacity or the internal volume of a container is called its capacity and is measured in litre (unit of capacity) or its multiples or submultiples, $1 dm^3 = 1$ litre.

- (vi) While measuring temperature and weight with the help of a thermometer and a spring balance respectively, we are measuring length, but the scale is calibrated in terms of $^{\circ}C$ or kg.

Note: The principle of calibration is not to be explained to the students at this stage.

- (vii) Estimation is an important skill of approximate measurement and improves with practice.
- (viii) The accuracy desired in measurement of physical quantity is determined by its amount, value and the physical quantity itself.
- (ix) It is necessary to have standard measures for different physical quantities. The old units such as inch, foot, yard, and mile for length; *seer*, *chhatank*, *maund* and tonne for mass are no longer allowed under law. This point needs to be emphasised.
- (x) A certain device is used to measure a physical quantity. For example a scale for length, a thermometer for temperature, a beam balance for mass and a watch or clock for time.

2.3 Activities

S. No.	Title	Items required	Skills to be developed	Remarks
1	2	3	4	5
1.	To use Scales for measuring lengths of common objects (straight and curved) (S).	Metre-scale and common measuring scales.	Estimation of common length; Use of measuring scales and the choice of proper scale and unit.	A tailor's tape or thread with scale is used for curved length.
2.	To measure areas of some common surfaces (S).	Cm-graph sheets and measuring scales.	Estimation of area of common surfaces and measurement of area.	m ² unit of area can be drawn on the board. Students should use it to estimate area of walls.

1	2	3	4	5
3. To measure volume of different objects (S).	Measuring jar, Overflow can, Tumbler, Bottle.	Estimation of volume of common objects and measurement of their volume, Capacity of a vessel and its use.		
4. To get familiarity with the unit of mass (S).	1 kg. load besides loads of 1 g to 100 g and a small beam balance.	Estimation of mass of objects in the range of 100 g to 1 kg, Use of beam balance.		
5. To become familiar with unit of time (S).	Watch, Second's pendulum, and clock.	Estimation of time intervals of a second and a minute, Use of different devices to measure time.	Students are familiar with time intervals of songs (3 minutes) and news (10 minutes) on radio.	
6. To demonstrate the use of thermometer and a spring balance (D).	Celsius thermometer and a spring balance.	Familiarization with linear scales used for measuring temperature and force.		

2.4 Relevance to daily life

Measurement of length, mass and time are important features in our daily life and are made with respect to some standard units. The units like a metre, kilogram and second are internationally accepted but sometimes we use approximate units like cubit or the span of the hand for measurement of length. Accuracy of measurement is often required in different situations.

3. EVALUATION

- (i) Students should be asked to list up the units (standard, multiples, submultiples) and the devices used for measuring the quantities like length, area, volume/capacity, weight, mass, and time.
- (ii) Students should be asked to estimate length, area and volume of some common objects, for example, length, breadth and area of a postcard, their science book and the black board; internal volume/capacity of a spoon, a match box, a cup and a bucket. They should also be asked to illustrate through an activity a duration of say 10 seconds and a minute. They should also try to estimate weight of some common light and heavy objects, say a 10p. coin, science book, school bag and a bucket full of water.
- (iii) Each student should find out and record with date, his own particulars such as height, weight, and lengths of cubit, foot and an average step.

4. REFERENCE MATERIALS

1. Physics for Entertainment, Part I—Y. Perelman, Mir Publishers, Moscow.
2. Time—S.A. Goudsmit and Robert Claiborne, Time-Life International, Netherland.

CHAPTER 2

MATERIALS AROUND US

1. OVERVIEW

Pupils know the names of several objects with their uses, e.g., sand, water, wood, glass, etc. Now they will learn more about them. There are different ways in which objects can be grouped, e.g., living or non-living, crystalline or amorphous; transparent, translucent or opaque; visible or invisible; soluble, insoluble or sparingly soluble; solid, liquid or gaseous, etc., as these have different properties. Substances may exist as elements, compounds or mixtures. The chapter also deals with recycling of waste materials; pollution, its causes and prevention.

2. LEARNING OUTCOME

2.1 Key terms

Elements; Atoms; Molecules; Compounds; Mixture; Reaction; Recycling; Pollution.

2.2 Major ideas and explanatory notes

- (i) Elements are the building blocks of all materials.
- (ii) Each element is made of very small particles which are called atoms.
- (iii) All atoms of any one element are alike, but atoms of one element differ from the atoms of another, e.g., atoms of gold are different from those of silver.
- (iv) Atoms of the same element come close together to produce a molecule of that element, e.g., hydrogen (H_2), oxygen (O_2) and nitrogen (N_2), etc.

- (v) Atoms of different elements react with each other in a definite proportion to form a compound, e.g., hydrogen and oxygen combine together to form water (H_2O) molecule.
- (vi) Though atoms and molecules are invisible but the elements and compounds are visible, e.g., we can see water easily but cannot see the atoms and the molecules present in it due to their small sizes.
- (vii) There are three ways of packing atoms and molecules in solids, liquids and gases. In solids, atoms and molecules are very close to one another; in liquids, there is more space for the atoms to move freely, but in gases the molecules are free to move in all directions.

2.3 Activities

S. No.	Title	Items required	Skills to be developed	Remarks
1	2	3	4	5
1.	To group different objects (S).	Sand, Water, Glass, Wood, Plastic comb, Oil (kerosene or mustard), Chalk pieces, Smoke (produced from a candle or Agarbatti) Salt, etc.	Classification	Grouping may be done on the basis of size, shape, colour, transparency, solubility in water, state of matter, etc.
2.	To prepare models of different geometrical shapes by using clay/plasticine (S).	Clay or plasticine.	Experimental skill	

1	2	3	4	5
3.	To test for hardness of some solid substances (S).	Pieces of wood, Stone, Glass, Iron, Wax, Aluminium, Copper, Plasticine, etc.	Experimental skill	Pupils may be made to arrange the substances in the decreasing order of their hardness after trying to scratch one substance with the other.
4.	To demonstrate the different ways objects behave when put in liquids and to examine densities of different substances (D).	Beaker 500ml, Glass, Jars, Aluminium lids (from milk bottles), Velvet cork, Wood pieces, Charcoal, Plastic pieces, Rubber cork, Iron nails, Water and kerosene oil, Rubber balloon filled with water, ice, etc.	Observation skill	
5.	To demonstrate the solubility of various substances (D).	Common salt, Sand, Sugar, Glass Tumblers, Water, Cap of a bottle.	Understanding of soluble and insoluble substances	
6.	To show that some substances are magnetic (S).	Iron nails, Copper Wire, Aluminium Wire, Pieces of clay, Pieces of broken utensils, Bar magnets.	Experimentation and observation	

2.4 Relevance to daily life

Man has discovered many metals such as iron, copper and aluminium. These discoveries have helped in progress of man, e. g., a tractor, which is made by using several metals, saves time and labour. Similarly cooking in a pressure cooker saves time and economises fuel expenditure, etc. We should use materials which are inexpensive according to our needs and interests. e.g., in the coastal regions of India, people use parts of coconut tree, mud and bamboo to build houses.

All old materials should be replaced by a new one only when the new one has either more advantages or less disadvantages than the older one. However, new materials are not always better than the existing ones, e.g., nylon may be harmful for the skin of some people.

Waste products can be recycled. It is for this reason that old clothes, broken aluminium, copper and iron vessels news papers, aluminium caps of milk bottles, plastic mugs, tumblers and buckets are sold in the market.

3. EVALUATION

- (i) The students may be asked to list the properties common to all solids, liquids and gases ?
- (ii) The teacher may ask the different properties of solids, liquids and gases.
- (iii) The students may give reasons for usefulness of grouping of objects into solids, liquids and gases ?

4. REFERENCE MATERIALS

1. Science, A textbook for Secondary Schools, Parts 1, II—1980, NCERT, New Delhi,

CHAPTER 3

SEPARATION OF SUBSTANCES

1. OVERVIEW

Pupils are already familiar with a large number of substances and their uses. The aim of teaching this topic is to acquaint the pupils with the faster, better and cheaper methods of separation of substances, from one another, which are being used in daily life.

2. LEARNING OUTCOME

2.1 Key terms

Decantation; Loading ; Filtration; Sieving; Magnetic separation; Winnowing; Boiling point; Distillation; Evaporation; Saturated solution; Crystallisation; Sublimation; Centrifugation; Chromatography.

2.2 Major ideas and explanatory notes

- (i) The substances which do not dissolve into one another can be separated by various methods. The teacher may use the examples given in the textbook. Some more are given below :
 - a. After rains, the distant objects are seen more clearly.
 - b. Sprinkling of water loads the dust particles and sweeping becomes easier.
- (ii) A substance can be dissolved in water upto some extent at a given temperature.
- (iii) A solid can be separated from a solution.
- (iv) Some solids can be converted into their vapour form by heating without going into liquid state. These substances are known

to be sublime, camphor, naphthalene, iodine, nau adar, (ammonium chloride). If a mixture of salt and camphor is heated in a clean closed tall glass bottle, white fumes of camphor sublime on the upper portion of the bottle,

- (v) The heavy and light materials mixed together can be separated by rotating the mixture. Separation of butter from the curd by churning or milk from cream.
- (vi) Two or more substances present in small quantities in a mixture can be separated by using a suitable solvent, e g , water, alcohol acetone, etc , on a piece of filter or blotting paper or chalk

2.3 Activities

S. No.	Title	Items required	Skills to be developed	Remarks
1	2	3	4	5
1.	To demonstrate the separation of mixture of sand, salt, iron filings and nausader-ammonium chloride (D).	Sand, Salt, Iron filings, Ammonium chloride, Funnel, Beaker, Filter, paper, Water, Bar magnet Heating device.	Observation	
2.	To demonstrate centrifugation process (D).	Saw dust, Sand, Glass rod or Spoon, Glass beaker or tumbler, Water.	Observation	
3.	To prepare copper sulphate	Copper sulphate, Beaker, Pro-	Experimentation and	

1	2	3	4	5
	crystals (D).	Porcelain dish, Glass rod, Trip- od stand, Filter paper, Funnel, Wire gauge, He- ating device	Observation	
4.	To demonstrate the separation of different constituents of black ink by chromatography (D).	Strips of filter paper, Boiling test tube, Glass rod, Test tube stand, Black ink	Observation	

2.4 Relevance to daily Life

We peel off the skin of banana for eating it. Pieces of stones left in rice or wheat grains are picked up and removed. Tea leaves are separated by using a wire mesh or a piece of clean cloth.

Finely ground particles are separated from whole wheat flour (atta) by passing it through a sieve. Naturally occurring water contains various useful salts dissolved in it. For example the dissolved iodine is useful for goitre disease. Red stone, we call ruby, is beautiful and precious because of some impurity present in it. It is therefore used for making jewels.

A small amount of copper is added to gold for making ornaments, which makes it hard.

3. EVALUATION

(i) The teacher may ask the separation of the following

a. Dust from floor; b. Dust from cloth; and c. Dust from vegetables

(ii) The students may explain how can scrap iron be picked out from a heap of waste?

(iii) The students may be asked how the salt can be obtained from sea water ?

(iv) The student may write how the crystals are prepared,

4. REFERENCE MATERIALS

1. Science, A textbook for Secondary Schools, Parts I, II—1980, NCERT, New Delhi.

CHAPTER 4

CHANGES AROUND US

1. OVERVIEW

Pupils are aware of the various changes taking place around them. In this chapter, the pupils will learn to classify the various changes that occur around them and will make a study of factors which influence the changes.

2. LEARNING OUTCOME

2.1 Key terms

Slow and fast changes;
Desirable and undesirable changes;
Periodic and non-periodic changes;
Reversible and irreversible changes;
Physical and chemical changes;
Interaction.

2.2 Major ideas and explanatory notes

- (i) The changes can be classified. The teacher may give the following examples :—
 - a. Slow changes : rusting of an iron nail, change of seasons, growth of a plant.
 - Fast changes : Burning of a match stick; exposing a photographic plate, breaking of a glass tumbler.
 - b. Desirable changes : Milk becomes curd; dead plants change into manure.

Undesirable changes : breaking of a glass tumbler, food going bad.

c. Periodic changes : It occurs after a fixed interval of time, e.g., the phases of moon, the high and low tides of the sea, the seasons, our heart beat. We can predict when it will occur again.

Non-periodic changes : It cannot be predicted when it will occur the next time, e.g. the rusting of an iron nail, melting of ice, appearance of some comets, growth of plants.

d. Reversible changes : Changes which occur in both forward and reverse directions under suitable conditions e.g, changing of ice into water and vice-versa, plant 'touch-me-not', 'Rain-tree' leaves fold after sun-set and open out again after sunrise.

Irreversible changes : Changes which occur only in one direction, e.g., burning of coal, aging, weaving out of materials.

e. Physical change : Nature of the elements and compounds of which the material is made does not change e.g., breaking of glass tumbler; glowing of electric bulb.

Chemical change : Nature of the material changes, e.g., hydrogen and oxygen combine to give water; coal burns in air to produce carbon dioxide and ash; milk becomes curd; magnesium ribbon burns in air.

(ii) In all changes, two or more materials come in contact and interact (act on each other) to change some of their properties. Some examples are:—

a. The pencil interacts with a blade; the pencil becomes smaller and blade gradually turns blunt.

b. A candle interacts with the oxygen of the air while burning to produce carbon dioxide, light and heat.

c. While striking a match stick against the match box, the interaction is easily seen in the match stick rather than in the match box.

- (iii) All the changes occurring in nature cannot be controlled. Some can be slowed down or prevented like undesirable changes : spoilage of food and rusting of iron objects. Some can be speeded up like desirable changes such as ripening of fruits (mangoes and bananas).

Some of the changes which cannot be controlled are the phases of the moon; the change from day to night and vice-versa; the seasons.

2.3 Activities

S. No.	Title	Items required	Skills to be developed	Remarks
1	2	3	4	5
1.	To observe germination of gram and pulses(S).	Beaker or glass tumbler, Pulses, Gram, Cotton or cotton cloth.	Experimental and observation	
2.	To demonstrate the changes in mixture of sulphur and iron filings on heating(D)	Sulphur, Iron, filings, Heating device, Boiling test tube, Bar magnet, Test tube holder.	Observation	
3.	To demonstrate the changes in wax during its heating and cooling(D).	Boiling test tube, Heating device, Test tube holder, Thermometer.	Observation	

2.4 Relevance to daily life

Control of changes is essential in our everyday life to prevent undesirable changes. Parents carefully plan a family budget for betterment of the whole family and change the income (money) into desirable food, clothing, shelter, proper education and amenities for all.

Milk is to be distributed to many children rather than for preparing sweets for a few people. Alcohol is to be used as a fuel for producing power and as a base for medicines rather than for drinking.

Cutting down trees in the forests may give us timber, fire-wood, enough space for agricultural land or for building houses, but may lead to decrease in rainfall, increase in soil erosion and lesser fertility of soil.

3. EVALUATION

- (i) Students may classify the various changes that occur around us in nature
- (ii) The teacher may ask them to explain interaction.
- (iii) How does 'interaction' influence a chemical change? Students may be asked to list some desirable and undesirable changes.

4. REFERENCE MATERIALS

1. Science, A textbook for Secondary Schools, Part I—1980, NCERT, New Delhi.

CHAPTER 5

MOTION, FORCE AND PRESSURE

1. OVERVIEW

The children are already familiar with the fact that motion is caused by a force. They have also learnt that there are different types of forces.

The present chapter deals with the different types of 'motions' and the various types of 'forces' which cause them. Motions can be of the following types: translatable; rotatory; vibratory and periodic. This distinction is based upon the mode of movement of the body. It is pointed out that the periodic motion can be used for measuring time.

The forces, which cause the change in the state of motion of a body and some times in its shape also, are of various kinds. At this stage only those forces have been dealt with which are commonly observed and are easily understood by the child. The concept of friction, which is a kind of force that arises when two surfaces are in contact with each other, is also introduced. The effect of force depends upon its magnitude and direction and also on the area on which it acts. The force divided by the area of the surface on which it acts is called the 'pressure' on that area.

The concepts of motion, force and pressure are interrelated and basic in the study of science. They are extensively used in the study of machines, motion of planets and satellites. These concepts are also used in the biological phenomena.

Note : At this stage only the qualitative idea about the force is given.

2. LEARNING OUTCOME

2.1 Key terms

Random; To and fro; Repetitive; Periodic; [Translational; Spinning (rotational); Vibrational (oscillatory); Frictional force and Friction; Magnetic force; Gravity and gravitational force; Ball bearings; Streamlining; Lubricants; Directions and magnitude of force; Deform; Weight; Pressure; Speed.

Teaching hint :

The word 'gravity' alone usually refers to the gravitational force of the earth. But in general there is a gravitational force between any two bodies.

2.2 Major ideas and explanatory notes

- (i) All motions are caused by one or the other type of a force.
- (ii) All periodic motions are repetitive but all repetitive motions are not necessarily periodic.

The distinction between the two types of motion-repetitive and periodic, should be noted clearly and brought out to the children. In repetitive motion, the motion repeats itself but the repetition may not be at regular intervals of time. When the period of repetition is same, the motion is called periodic motion, e.g. the movement of a lawn mower or a plough in the field is repeated from one to the other end but at different intervals of time. On the other hand, the movements of a swing (jhula) and of the hand of a watch are examples of periodic motion.

- (iii) Force can change the state of motion of a body, direction of its motion and its shape. In some cases none of the above changes may be visible. In such cases there may be a change in molecular arrangement but the effect is not visible.
- (iv) The frictional force between two surfaces depends on their nature and smoothness.
- (v) A force has magnitude as well as direction.

- (vi) Speed, time and distance are related ($\text{speed} = \frac{\text{distance}}{\text{time taken}}$).
- (vii) Force acting perpendicularly on a unit area of the surface is called pressure.

If the area is fixed, the pressure increases with the increase in force. Pressure also increases if the force remains constant but the effective area decreases.

2.3 Activities

S. No.	Title	Items required	Skills to be developed	Remarks
1	2	3	4	5
1.	To observe some of the moving objects(S).	Watch, Measuring rod.	Measurement of distance and time.	
2.	To measure the speed of rotation of a wheel (bicycle/ potter's wheel/gramophone)(S).	Wheel, Watch.	Measurement of time and careful counting of the number of revolutions.	
3.	To measure the time period of a swing or pendulum(S).	Watch, Swing, String and a heavy small weight (stone etc.).	Improvising a pendulum and measurement of time.	
4.	To measure a distance moved by a ball on various types of surfaces like cement floor, road and grassy lawn(S).	Ball and metre scale or measuring rod.	Setting the ball in motion with equal force.	This can be easily done by letting the ball slip down an inclined plane from a constant height.

1	2	3	4	5
5.	To cut the stem of a plant or thick thread with a knife by its sharp and blunt edges by applying equal force in two cases(S).	Knife, Stem.	Understanding the idea of pressure.	
6.	To organise a Tug-of-War competition(S).	Rope	Understanding of relative magnitude and direction of forces.	

Teaching hints :

Activity (4.4) given in the textbook may not be a practicable one as the difference in the time for the light and sound to reach the child may be too small to be easily perceptible without proper equipment. In the activity (4.16) of textbook the conclusions are likely to be different for different students. About the activities included in the textbook under the section 'observation'.

- (i) In example (e), the molecules of water are constantly moving and this causes the movement of potassium permanganate in water.
- (ii) In example (f), the cause of motion of ink may be difficult to explain at this stage, as it involves concepts like capillary action.
- (iii) Examples (g) and (i) are not good examples of motion because there is no apparent movement of any thing here. These may be omitted.

2.4 Relevance to daily life

In daily life we see different types of motion. The types of motion help the child to classify the motion. The idea of speed gives the quantitative knowledge of how fast things move. The knowledge of pressure helps to know how a knife or a scissor help us to cut and

how a nail can be fixed. The concept of force is also important as it makes things move and stops moving objects.

3. EVALUATION

- (i) The teacher can ask the children to observe various kinds of motions around them (e.g. movement of fan, movement of leaves of a tree) and then categorise under heads like rotational, random etc.
- (ii) The children may also be asked to identify the forces causing the motions listed in the previous activity.
- (iii) The children may list those phenomena where the pressure is different although the force applied is the same e.g. the pressure applied at the sharp and the blunt edges of a knife is different.
- (iv) The children may be asked to observe and list the different materials used for minimising friction

4. REFERENCE MATERIALS

1. Physics for Entertainment, Parts I, II—Y. Perelman, Mir Publishers, Moscow.
2. Physics, Foundations and Frontiers—G. Gamow, Prentice-Hall of India, New Delhi.

CHAPTER 6

SIMPLE MACHINES

1. OVERVIEW

The students have an elementary introduction of simple machines around them. The present chapter aims at familiarising them with the machines.

A machine is a device which makes it easier or more convenient for us to do a job. Here, with the introduction of the idea of load, effort and fulcrum, it is emphasised that to do work with machines an effort from an outside agent is needed to overcome a load.

We use one or the other machine in our day to day life. There are simple machines like a knife, a tong and complicated machines like a bicycle, tractor or a crane.

2. LEARNING OUTCOME

2.1 Key terms : Machine; Lever; Pulley (fixed and moveable); Inclined plane; Screw; Lubrication; Fulcrum; Effort; Load; Beam balance; Jack; Crane.

2.2 Major ideas and explanatory notes

- (i) A small force applied at a point far away from the fulcrum can move a large load placed near the fulcrum.
- (ii) Machines can increase the effect of a force or a small applied force can be used to overcome a large force.
- (iii) Machines can also be used to change the direction of the applied force into a more convenient direction.

(iv) Various types of simple machines are lever, pulley, inclined plane, screw and wheel.

(v) All complex machines are a combination of one or more simple machines.

(vi) In order to work efficiently with machines proper care and lubrication of the machines is necessary.

2.3 Activities

S. No.	Title	Items required	Skills to be developed	Remarks
1	2	3	4	5
1.	To lift a heavy log of wood using a long bar(S).	A wooden log, A long bar, and a support (as shown in the textbook).	Practical use of lever.	Activity should be tried with change of fulcrum, Need for a strong and stout bar should be brought out.
2.	To make a beam balance(S).	Thin wooden stick, Two pans and string, Marbles, Coins.	Accurate measurement of weight.	A strong measuring scale with holes can also be used as a beam of the balance.
3.	To study the use of pulley for lifting a stone(S).	Pulley, Stand for fixing the pulley, Load, Rope, Spring balance.	Use of a pulley for applying force conveniently.	A Pulley can be improvised from a bobbin or from a piece of strong tubing.

1	2	3	4	5
4.	To make an inclined plane(S).	Wooden plank, Pile of books, Spring balance Block of wood	Measurement of angle and use of an inclined plane for raising a load conveniently.	
5.	To make a model of a screw(S).	Sheet of paper, Pencil, Scissors, Set square.	Model making	

2.4 Relevance to daily life

The knowledge of simple machines and their application is advantageous in day-to-day life. The children observe a sweeper cleaning the street with a broom having a long handle, an iron-smith holding a hot iron piece with a pair of tongs, a person taking out water from the well using a pulley, a cart-puller taking his cart out of the mud using logs of wood, a tractor ploughing the field, a crane lifting heavy load, etc. The knowledge of machines helps them in understanding the function of various machines.

3. EVALUATION

- (i) The students may be asked to prepare a list of simple machines they use and see around them and to classify them as lever, inclined plane, etc.
- (ii) The students may be asked-kind of machine a knife is.
- (iii) A door opens and closes with a lot of effort. Its hinges are oiled and the door starts moving freely. Students may explain the reason behind this.

4. REFERENCE MATERIALS

1. Learning Science Through Environment, A textbook for class V—NCERT, New Delhi.
2. Inventions that Changed the World—Mir Najabat Ali; National Book Trust, New Delhi.

CHAPTER 7

THE UNIVERSE

1. OVERVIEW

The children have already learnt in primary classes some facts about the sun, the moon, the stars and planets in the sky. They also know that there are phases of the moon. They have also learnt that lunar and solar eclipses occur.

In this chapter children will learn more about the heavenly bodies including comets, meteorites, shooting stars and about the vastness of the universe. They will also learn more about the motion of the earth, the moon and the planets along with the related effects. The methods for estimating the distances of the heavenly bodies are also discussed. The chapter also gives some information about the solar and lunar calendars.

Note : As the topic of the universe is vast, most of the contents of this chapter may be taken to be for information to the children. The understanding and appreciation of the abstract concepts by the children at this stage may be somewhat difficult.

2. LEARNING OUTCOME

2.1 Key terms

Heavenly objects; Stars (Sun); Planets (earth, mars etc.); Comet and shooting stars; Satellites-natural (moon) and artificial (Arya Bhatta, Bhaskara); Clusters; Constellations (Great Bear, Ashwini, Bharani, Chitra, & Mriga); Phases of Moon; Tides (high low); Eclipses-Solar, lunar, partial, total, annular; Boundary or limit of the sky (Universe); Astronauts; Atmosphere; Density of medium; Rays-X, ultraviolet, heat; Scattering;

Components of white light; Pole star; Poles-north, south. Equator; Axis; Solar system; Method of triangles, Binocular; Telescope. Galaxy; Laser; Zig-zag path; Light emission and reflection; Horizon; Earth-light and Sun-light, Calendars solar, and lunar (Hijr); Year-lunar, solar. Apparent size; Planes of motion, Pin-hole; Gravitational pull. Rigid; Bulge; Dust of comet; Elements, Space vehicle.

2.2 Major ideas and explanatory notes

- (i) The rays of the sun travel through shorter distances of the atmosphere to reach the same place on the earth at noon than in the morning or evening.
- (ii) Many stars are arranged in well identified groups called constellations.
- (iii) The rays of light are scattered uniformly in all the directions by the molecules of air.
- (iv) White light consists of different colours.
- (v) The sun, the moon and other planets appear to move from east to west in the sky because the earth spins from west to east about its axis.

Note : Movement from west to east is anticlockwise when seen from the north pole.

- (vi) The pole star does not appear to move while the other stars appear to move around. This is because the axis about which the earth spins, points exactly in the direction of the pole star. It has also been illustrated in the textbook. It can also be demonstrated with the help of an umbrella as given in the activities section.
- (vii) The earth and other planets keep revolving along a certain path (circular or elliptical) and do not go astray around the sun due to the gravitational force.

- (viii) The separation between two objects, a large distance apart, can be measured by the method of triangles.

Note : This is a difficult concept and may be avoided by the teacher for this age group of children.

- (ix) Stars twinkle while the planets do not.
- (x) The moon revolves around the earth in a near circular path while it moves around the sun (together with earth) in a zig-zag path. The term 'zig-zag' has been used as a simple word for 'helical'. The illustration on this in the textbook is not very clear.
- (xi) The moon and the planets are visible because they reflect light from the sun.
- (xii) The phases of the moon are caused by its motion around the earth.
- (xiii) The difference in moon rise is of 48 minutes later every day. The fact that moon rises later every day may be understood by the children relatively easily. It is because during the 24 hours the earth completes one rotation by the time moon has also moved some distance ahead. The students may be asked to actually observe the moon rise on some successive days, and find out for themselves the difference in time of its rise every evening.
- (xiv) The lunar eclipse is caused by the formation of the shadow of the earth on the moon.
- (xv) The solar eclipse is caused by the formation of the shadow of the moon on the earth.
- (xvi) The gravitational pull of the moon produces tides in the sea. (This may be difficult to understand specially by the children who have not had the opportunity of observing the tides actually in the sea. It may be passed on as a mere information for them).
- (xvii) The planets move around the sun approximately in the same plane.
- (xviii) So far there is no evidence of life on any other planet.

2.3 Activities

S. No.	Title	Items required	Skills to be developed	Remarks
1	2	3	4	5
1.	To observe the sky at night(S).	"Science Reporter", magazine	Recognition of the planets Venus, Jupiter and Mars and some well known constellations.	The teacher may consult some star charts (e.g. monthly chart which appears in "Science Reporter").
2.	To study and record the time of sun rise and sun set(S).	A watch and the daily newspaper	Understanding that times of sun rise and sun set change from day to day.	The sun rise and sun set should be observed from a high building in an open space.
3	To demonstrate the motion of other stars around the pole star with the help of an umbrella(D).	Umbrella	The child learns that the pole star does not move but other stars appear to move around it.	Mark a few crosses to represent stars on the inside cloth of the umbrella. Consider the pole star to be the point where the end of the metallic handle of the umbrella meets the cloth. As the umbrella is rotated, the child standing below it will see that the pole star does not move, but the stars will appear to move around it.

1	2	3	4	5
4.	To observe and record the phases of the moon and the time of moon rise from new moon to full moon(S).	Watch	Familiarity with the phases of the moon. Moon rises later every day.	The teacher may demonstrate how the phases occur by activity as given in the class V book Environmental Studies or some similar book.
5.	To compare the different calendars(S).	Different calendars or charts.	The child learns that the dates of the festivals will differ according to the different calendars.	The teacher may look up the dates of certain festivals like Diwali, Id, Raksha bandhan etc. according to the solar calendar and the hindu and muslim lunar calendars for two or three years.
6.	To measure the length of school playground using method of triangles(S).	Protactor, divider and measuring tape.	Application of method of triangles.	

2.4 Relevance to daily life

Night sky is very fascinating. On a clear night children love to watch the sky. This chapter provides interesting information to the children for watching the night sky and to know several scientific facts about the heavenly bodies.

The study of the universe is not only interesting in itself, it also helps children to find answers to some of the questions like 'what is the origin of the earth and other planets?' 'How far are the sun and moon from us?' and 'how vast is the universe?'

3. EVALUATION

- (i) The teacher may give the distance of some well known cities from the children's village, town or city and ask the children to draw these distances on a suitable scale on outline map of India or a graph paper with scale indicated on it.
- (ii) The children may be asked to draw a chart of the solar family, sizes of the planets and the sun can be taken according to one scale and the distance between them according to another.
- (iii) Students may be asked to observe phases of the moon from a new-moon to full-moon and keep a diary of the time of rise of moon and its position in the sky (east/west). These observations may then be discussed in the class.
- (iv) The students may note the times of sun set and sun rise on alternate days for a period of a month and draw these times on a graph paper.
- (v) The students may be asked to observe and draw the colours obtained when light shines on a soap film or a glass tumbler containing water.

4. REFERENCE MATERIALS

1. Science Reporter—a monthly magazine, CSIR, New Delhi.
2. Learning Science Through Environment, A textbook for Primary Schools, Class V—NCERT, New Delhi.
3. Science is Doing, textbook for Class V—NCERT, New Delhi.

CHAPTER 8

THE LIVING WORLD

1. OVERVIEW

The teachers are expected to inform the students that there are a large number of objects around us, and we can easily recognise them as living and non-living. There are various types of living objects which have certain common features among themselves. They can be grouped into two broad categories—plants and animals having some differences among themselves. The students can also recognise the differences between living and dead objects.

All living objects arose from non living material and in the course of time, the simpler forms modified into complex ones. This knowledge will provide a background for detailed studies of plants and animals.

2. LEARNING OUTCOME

2.1 Key terms : Evolution; Excretion; Gill slits; Sanctuary; Species; Yeast; Classification; Photosynthesis, Scientific name.

2.2 Major ideas and explanatory notes

- (i) There are variety of living organisms around us which vary in size, shape and food habits.
- (ii) All living organisms have certain common characteristics.
- (iii) Each kind of living form constitutes a species.
- (iv) Based on the similarities and differences species can be classified.
- (v) Species and genus form the scientific name.

- (vi) Animals communicate with each other.
- (vii) Life originated from simple non living elements and compounds and gradually evolved into the complex ones

Notes :

1. The teacher may use the following information to explain some names of the organisms.
 - a. The slug, snail and water mussels belong to the group mollusca but the slug is a shellless mollusc.
 - b. *Acacia* is a large flowering spiny tree.
 - c. **Flamingo**—a crane like bird.
 - d. *Planaria*—a free living flatworm.
 - e. **Sea anemone**—a marine animal.

Some examples given in 1.1 section of the textbook are not usually seen around us with naked eye, for example—malarial parasite. They are microscopic and reside within other organisms as parasites. More details are given in section 1 in the textbook.

2. Microscopic forms of plant *yeast* convert sugar to alcohol and carbon dioxide. Milk is changed to curd by bacteria *Lactobacillus*. These two phenomena may be explained in the simplest possible way. Some organisms are useful to mankind like sheep, cow etc. Some are harmful to mankind like malarial parasite, tapeworm etc. Some organisms may not have any direct use to man, they are in one way or other useful, e.g. cat which destroys rats. Some organisms may not be directly harmful to us, but in an indirect way may cause harm to us like some parasites of plants and animals used as food by us.
3. Duck is an example of swimming and flying organism. The student can add another two forms like burrowing (moles) and creeping (snakes).

4. All mosquitoes are not the carriers of malarial parasite. Only the female *Anopheles* has piercing mouth parts and is the carrier of the disease. Males are not capable of sucking blood as their mouth parts are not piercing type.
5. Response to stimuli by plants may be explained by the teacher e.g. light. Plants can manufacture food but animals cannot. Plants cannot move while animals usually move in search of food.
6. The atmosphere became suitable for life to appear. Small gradual changes were responsible for the new forms of organisms to appear. These changes were probably needed to survive in the changing climatic conditions. The changes arose due to the organisms living in various habitats to which they had to adapt themselves for survival causing the gradual changes in their structure resulting in the formation of new forms.
7. The teacher may explain the scientific names and generic and specific parts in the following.

Organisum	Geneus	Species	Common name
Animal	<i>Panthera</i>	<i>tigris</i>	Tiger
	<i>Panthera</i>	<i>pandus</i>	Leopard
Plant	<i>Solanum</i>	<i>tuberosum</i>	Potato
	<i>Solanum</i>	<i>melongena</i>	Brinjal

8. In case of man the ability to communicate is highly developed with written and spoken form of language. Some of these qualities of communication are also found in other organisms, but in case of man it is highly developed. Man is more adaptable and his capacity to think and adjust has made him powerful. His intelligence is supreme among all known living organisms.

2.3 Activities

S.No.	Title	Items required	Skills to be developed	Remarks
1	2	3	4	5
1.	To list all the animals and plants around you (S).	Notebook, pencil	Knowledge about plants and animals in the locality.	
2.	To collect atleast two animals and two plants from your locality (S).	Insect nets, Bell jar or tumbler with cover, polythene bags, Hand lens, Watch glass.	Method of collection, maintenance, Observation and preservation.	
3.	To write down the differences between living and non-living objects(S).	Notebook, Pencil.	Observation and identification.	
4.	To draw any two plants or animals that you have collected or observed (S).	Drawing sheet, Coloured pencils.	Drawing, Observation	
5.	To classify the organisms given in the cards into different groups(S).	Picture cards	Classification, Observation	Grouping can be done with reference to size, habitat and food habits etc.
6.	To observe the growth of living and non-living objects (S).	Seeds; Soil, Beaker, Thread, Glass rod, Copper sulphate solution.	Setting up an apparatus. Observation.	

2.4 Relevance to daily life

The children observe number of plants and animals around. They also hear about plants and animals found in forests, sea, desert and mountains. It is to point out that all these plants and animals are the members of the living world. They differ among themselves but at the same time exhibit certain common features, which are the properties of life. These properties are also seen in human beings. They therefore along with plants and animals are members of the living world and share the environment together with others.

EVALUATION

- (i) Classify the organisms given in list 1.1 of textbook into groups living on land, in freshwater, sea, air and parasites both on land and in water.
- (ii) The teacher may ask about the migration of birds and give factors responsible
- (iii) Teacher may ask the students to name plants or animals made up of only one cell.
- (iv) Teacher may give two examples like bean plant or mango tree or a cow or a cat and ask them to write down the similarities and differences.

REFERENCE MATERIALS

1. 'Common birds (Hind revised Edition)'—Salim Ali and Lacey Futehally, National Book Trust, New Delhi.
2. Watching birds—Jamal Ara, National Book Trust.
3. 'Who's Who at the Zoo'—Ruskin Bond, National Book Trust.
4. Flowering Trees—M. S. Randhawa, National Book Trust.
5. Garden Flowers—Vishnu Swarup, National Book Trust.
6. Common Trees—H. Santapau, National Book Trust.
7. Bird Migration—N. N. Majumdar, NCERT, New Delhi.
8. Visit to a National Museum of Natural History or Zoo.

CHAPTER 9

STRUCTURE AND FUNCTION IN PLANTS AND ANIMALS

1. OVERVIEW

Diverse kinds of animals and plants exist on the surface of earth. The chapter deals with both plants and animals and their different parts performing different functions. In some organisms, some parts are modified to perform functions other than the normal ones. Removal of some parts from the organisms will interfere with their normal functioning. All living organisms produce their own kind through reproduction.

2 LEARNING OUTCOME

2.1 Key terms

Amphibia; Annelida; Appendix, Arthropoda; Aves; Breed; Communication; Dissection; Egg; Germination; Mammalia; Modification; Modified parts, Pisces; Pollen grains Reptile; Reproduction; Reproductive cells; Sense organs, Snout; Sperm; Suspended growth; Vegetative propagation; Weeds.

2.2 Major ideas and explanatory notes

- (i) Both plants and animals have parts differing in shape, size and several other features.
- (ii) The organisation of part in each organism helps in carrying out the various activities. The removal or disuse of parts effect the organisation of the organism
- (iii) All the vital activities like nutrition, respiration, excretion and response to stimuli are important for the living of the individual but reproduction is required for the continuity of the race.

- (iv) All living organisms tend to spread from one place to other.
- (v) The living species gather information about their environment and respond to it in various ways.

Notes :

1. Teacher may consult Table I of the textbook and explain the structure and function of various parts of a plant as well as the modification of their parts along with functions
2. Heart, nerves and nipples are found in different animals at different places. Heart is on the dorsal side e.g. prawn, frog and on ventral side in all other animals—man, lizard etc. Nerves are on ventral side in earthworm and on dorsal side in frog. Nipples are thoracic in monkeys and abdominal in case of cow, dog and goat.
3. While explaining the different sizes of various organisms, teacher may give the example of man having average size of 175 cm; other examples are 160 cm (cow) and 168 cm (buffalo).
4. The teacher may be equipped with the information on structure and function of both internal and external parts of various plants and animals as given in the textbook.
5. Same parts are modified in different animals e. g. pectoral fins in fish; wings in birds. Pectoral fins and wings are modified parts of forelimbs.
6. Teacher may draw attention to certain specific characteristic features of some of the organisms e. g. beak of a bird, gizzard (Cockroach) and appendix (man).
7. Various types of reproduction may be explained with more examples, Suspended growth may be explained as the phase to overcome unfavourable conditions.
8. Unwanted Plants—weeds;—e.g. Grass, Bathua Like wise there are unwanted animals-pests, rats and locusts.

2.3 Activities

S.No.	Title	Items required	Skills to be developed	Remarks
1	2	3	4	5
1.	To demonstrate the collection and preservation of a few plants from the locality(D).	Measuring cylinder, Scissors, Khurpi, Polythene bags, Herbarium sheet, Old newspapers	Preparation of solution, drying and fixing of specimens.	
2.	To demonstrate the preservation of a few animals from the locality (D).	Glass bottles, (500ml), Formalin solution, Cardboard, Pens, Display board.	Handling of animals, Preservation technique.	
3.	To list the various parts and functions of a few plants (S).		Observation	
4.	To collect flowers and study the pollen grains (S).	Scissors, Needles, Hand lens, Forceps, Glass slide, Microscope.	Collection, Mounting.	The teacher may mention that the pollen grains cause allergy.
5.	To collect and study different types of seeds (S).	Hand lens, Forceps, Needle, Microscope.	Identification	
6.	To study vegetative propagation in some plants(S).	Potato, Rose, Sugarcane, Cactus, Garlic, Bryophyllum leaf, Mint, Lawn grass	Knowledge of various modes of propagation and plant parts involved.	

1	2	3	4	5
7.	To study external parts and their functions in some common animals (S)	Scissors, Tumbler, pitcher plant, Glass container.	Observation	
3.	To identify and group various plants and animals from the picture cards provided (S)	Picture cards	Observation, Identification.	Teacher may group the animals and plants with the help of the cards on the basis of structure, function and habitat.

2.4 Relevance to daily life

Organisms have different parts. Each part as well as an organism has a role to play in the living world. The knowledge of function of various parts and their proper use and maintenance is necessary. Though each part has an important role to play but some parts are essential—Head, Brain and Roots in flowering plants, without which the organism is not able to survive. The knowledge of organisms helps us to discriminate the unwanted from the wanted ones.

EVALUATION

- (i) Students may be asked to name animals which have body parts like hair, claw and external ears.
- (ii) The teacher may test by making a list of certain organs of organisms and ask the students to identify the removal of which organ or organs may cause death or reduce capabilities.
- (iii) The teacher may ask the students to name certain structures which perform different functions in different species.

REFERENCE MATERIALS

1. Biology, A textbook for Hr. Sec. Schools Classes XI, and XII, Part I—NCERT, New Delhi,

CHAPTER 10

FOOD AND HEALTH

1. OVERVIEW

All organisms need food for growth and maintenance of life. The chapter explains the composition and preparation of food by the organisms. The food mainly consists of proteins, carbohydrates, minerals, fats, vitamins and water. In case of green plants food is manufactured by themselves in presence of sunlight and water from soil and carbon dioxide from the air. The major food compounds are grouped as essential and non essential. The requirement of nutrients varies from individual to individual. Food is the chief source of energy and plays a major role in maintaining our health. To lead a healthy life proper amount of food is required. Food items need care and preservation to avoid its spoilage.

2. LEARNING OUTCOME

2.1 Key terms

Amino acids; Balanced food; Meal; Diet; Carbohydrate; Energy; Essential nutrients; Fats; Fatty acids; Hibernation; Minerals; Proteins; Replacement and repair of worn out parts; Spores; Vitamin; Cereals; Pulses; Diabetes; Beaver.

2.2 Major ideas and explanatory notes

- (i) The food is required by all living organisms for growth, replacement of the worn out parts, repair of damaged parts and energy.
- (ii) Different nutrients are essential for different species.
- (iii) Balanced diet provides right amount of essential nutrients.

- (iv) The substances present in the food are classified into major groups.
- (v) The requirement of these substances varies from individual to individual.
- (vi) Plants manufacture their food by themselves.
- (vii) Food gets spoiled due to the activity of some micro-organisms like bacteria.
- (viii) Some of the organisms have developed a mechanism of leading life without food.

Notes :

The teacher may point out that the sick plants referred here are sick due to non-availability of food rather than a disease. Plants may also suffer from deficiency diseases, e.g. Yellowing of leaves due to deficiency of Nitrogen, Sulphur and Iron.

The Teacher may explain the hidden energy as the energy remaining within the food substances but in a different state and is converted into the required form by the chemical reactions going on within the body.

Essential nutrients are the substances which the body cannot make and they must be supplied in a readymade form so that they can be absorbed as such.

Raw materials here refers to protein, carbohydrate and fats.

The balanced food is the food which supplies the essential nutrients in their right amount to provide the required amount of energy.

The teacher may draw the attention of the students to the fact that the food stuffs in whatever form they may be, are derived from the plants directly or indirectly.

The teacher may mention the source of amino acids (Proteinaceous food) and fatty acids (fats from milk, ghee and vegetable oil).

The teacher may refer the incident of conversion of milk into curd as an example of bacterial action on food,

9. The teacher while explaining the terms suspended life and hibernation may recall the phenomenon of slowing down of metabolic activity.
10. The non-essential part of the food can be synthesised within the body from other sources, these need not be supplied in the same readymade form

2.3 Activities

No.	Title	Items required	Skills to be developed	Remarks
2		3	4	5
.	To list the uncooked daily food items and classify them into the major food groups (S).	Notebook, Pencil.	Observation, Identification	Teacher may ask them to classify into protein, carbohydrate and fat rich food items. Teacher can use charts made by the children.
	To classify the food materials into different groups with the help of given picture cards (S).	Picture cards	Identification	
.	To observe the spoilage of food and study some causative organisms (S),	Bread, Pickel, Jam, Milk, Petri dishes, Glass slides, Needles, Methylene blue, Microscope.	Observation, Mounting.	

2.4 Relevance to daily life

This knowledge highlights the need to preserve the food especially during its transport from place to place without decreasing its food value. It helps us to select right type of food-balanced diet for different people including sick for good health. This also speaks for the need of balanced food along with factors like medical treatment and proper environmental sanitation.

3. EVALUATION

- (i) The teacher can make a list of food substances and ask the children to identify stuffs rich in proteins, carbohydrates and fats.
- (ii) The teacher may ask the students about the requirements of food for man working in the field and for the children.
- (iii) The students will write the impact of cutting down of all the trees of the locality.

4. REFERENCE MATERIALS

- 1. You and your health—V. N. Bhawe and others, National Book Trust, New Delhi.
- 2. Fight against disease—R. Kalyanasundram, NCERT, New Delhi.

CHAPTER 11

MAN'S DEPENDENCE ON PLANTS AND ANIMALS AND THE BALANCE IN NATURE

1. OVERVIEW

The chapter highlights the ways the diverse kinds of plants and animals are dependent on one another. The most important example being plants as essential component of the food chain on which all living organisms are dependent. We get many useful products from plants and animals. Other organisms are also dependent on each other for the successful survival. The food chain, the birth rate, death rate along with other environmental factors maintain the balance in nature.

2 LEARNING OUTCOME

2.1 Key terms

Lard (animal fat) ; Gelatin (Jelly like proteins) ;

Decomposition ; Fertilizer ; Food chain ; Prey ;

Scavengers ; Ovary ; Weed ; Lac ; Shellac ; Sludges ;

Versatile, Predators ; Parasite ; Orchard ; Herd (grazing cattle living in group).

2.2 Major ideas and explanatory notes

- (i) The food that any animal including man take comes directly or indirectly from plants.
- (ii) Besides food, plants and animals are of several other uses to us.
- (iii) All the living organisms are dependent upon each other.
- (iv) The interdependence can be observed by studying the food chains.
- (v) Several living species live in association with each other.
- (vi) These associations help in maintaining the balance in nature.

Notes :

1. Balance in nature should be explained by examples within a population, between the populations, between the organisms and the environment.
2. Oysters are found in sea, turkeys is a big bird found in Mexico.
3. The teacher may explain the role of pollens in fertilization of egg.
4. The teacher may point out that the bees collect the nectar from the flowers and convert it into honey.
5. Silk gland is the gland where the silk is produced.
6. All parasites are harmful, they cause diseases and harm the organs of the body.
7. Nitrogen is an essential component of proteins. Certain bacteria (*Rhizobium*) fix nitrogen of the atmosphere into a form which is component of protein. Most of the nitrogenous fertilizers (super phosphate, urea) are useful for plants.
8. We are degrading and polluting the environment by cutting and felling forest trees, throwing chemicals in rivers thereby endangering the aquatic animals like fishes. Meadows are vanishing due to overgrazing by the cattle thus threatening the survival of other species. Water hyacinth is a weed which grows very fast and clogs the pond thus making it unusable.

2.3 Activities

No.	Title	Items required	Skills to be developed	Remarks
2		3	4	5
	To demonstrate erosion of soil by wind and water (S).	Trays, Beakers Shower, Soil with grass, Fan and Sand.	Observation	

1	2	3	4	5
2	To study the dependence of man on plants and animals(S).	Cotton, Wood, Rubber, Gum, Vegetable, Fruits, Crops, Leather, Honey, Wool, Silk, Egg.	Collection, Identification, Grouping.	
3	To study food chain and balance in nature (S).	Picture cards of different plants and animals	Identification, Grouping.	

2.4 Relevance to daily life

The knowledge of this chapter helps in knowing the products and their sources i.e. whether obtained from plants or animals. It also helps us maintaining the balance in nature. The common observations we find are cats kill the rats for their food, mosquitoes suck the blood of man, vultures eat the remains of dead animals. It makes us to realize our position and role in the living world.

3. EVALUATION

- (i) The teacher may ask the parts of wheat, potato, guava plants eaten by people.
- (ii) The students may be asked to name the food stuff which contains gelatin?
- (iii) The students may be asked to list the animals used for carrying loads, pulling vehicles and ploughing?
- (iv) Students may name some diseases caused by bacteria. The expected names may be pneumonia, cholera, typhoid, and tuberculosis.
- (v) The names of some common fertilizers may be asked.

4. REFERENCE MATERIALS

1. Science, A textbook for Secondary Schools Part I—NCERT, New Delhi,
2. Biology, A textbook of Biology for Higher Secondary Schools, Part I, II—NCERT, New Delhi.

CHAPTER 12

ADAPTABILITY TO THE ENVIRONMENT

. OVERVIEW

Students know that organisms are of diverse kinds and live in different environments. Here they will learn why all the living organisms must adjust to their external surroundings as well as internal environment for their survival. This chapter explains how the environmental changes are continuous and the organisms adapt to these changes to live successfully. In some cases, they even perish, e.g. Dinosaurs. Organisms get diseased due to either organisms or foreign substances. How they fight against the invasion of foreign substances by destroying them with the chemical substances produced in body is also discussed ?

. LEARNING OUTCOME

2.1 Key terms

Humidity ; Infection ; Rhythms ; Disease ; Virus ; Antibodies ; Enzymes; Adaptation ; Infectious disease.

2.2 Major ideas and explanatory notes

- (i) The environment is undergoing continuous changes.
- (ii) Some factors are responsible for the changes in the environment.
- (iii) Internal conditions of our body are also continuously changing.
- (iv) Sometimes our body is invaded by foreign substances.
- (v) Most of the processes in our body like other living organisms are also rhythmic.
- (vi) All the living organisms including man adjust and adapt to these changes.

Notes :

1. All chemical reactions in human body take place at 37° C. The body temperature does not fluctuate with the environmental changes. All such organisms are called warm-blooded animals e.g. man. But in case of frog and fish, the body temperature fluctuates with environment and hence they are called cold blooded animals.
 2. Viruses show the property of living when only the living organisms but outside the host organisms they remain in the inactive non-living form.
 3. Enzymes also help in breaking down the food substances and help in digestion.
 4. The metabolic activities like digestion and excretion help in removing the enemies from the body.
- (e) Rhythmic processes are the processes occurring at regular intervals.

2.3 Activities

S.No.	Title	Items required	Skills to be developed	Remarks
1	2	3	4	5
1.	To study adaptability in human beings (S).	Glass tumblers, Spirit lamp, Tripod stand, Test tube, Test tube holder.	Observation	
2.	To study the adaptation in plants and animals (S).	Picture cards of plants and animals along with enlarged pictures of adaptive parts.	Observation, Identification.	Teacher may show adaptation in Cactus, Grasshopper and Water hyacinth.

2.4 Relevance to daily life

Our heart beats faster for speedy circulation of blood which provides energy while running. Similarly when we go up the hills for sometime, we feel breathelessness due to less amount of atmospheric oxygen but we get adjusted to it in a very short time. The knowledge gained in the chapter helps us in knowing the habitats of different organisms.

3. EVALUATION

Teacher may ask the students about the various adaptations observed in Grass hopper, Zebra, Chaemalion. Tiger and Lion are adapted to meat eating.

4. REFERENCE MATERIALS

1. Adaptations—Foundations of modern biology series, Prentice Hall of India Pvt. Ltd., New Delhi
2. The Cat Family—M.D. Chaturvedi, National Book Trust, New Delhi.

CHAPTER 13

WATER

1. OVERVIEW

The children already know that water is found all around and is used for drinking, washing and gardening purposes. A large number of living organisms live in water. This chapter deals with the importance, sources and use of water. The necessity of removing impurities from water, its nature as a universal solvent and the chemical composition are also discussed.

2. LEARNING OUTCOME

2.1 Key terms

Air currents; Aquatic animals; Drainage system; Ground water; Hard water; Hardness of water; Moisture; Perennial; Soft water, Transparent; Water cycle.

2.2 Major ideas and explanatory notes

- (i) Water is essential for life.
- (ii) Water cycle.
- (iii) Hardness of water and its removal.
- (iv) Purification of water.
- (v) Usefulness of water.

2.3 Activities

S.No.	Title	Items required	Skills to be developed	Remarks
1	2	3	4	5
1.	To collect water from various sources and	Beaker or glass tumblers, Water	Experimental, Observation	

1	2	3	4	5
	examine various impurities present (S).	from different sources, Watch glass, Magnifying glass.		
2.	To taste drinking water obtained from different sources (S).	Test tubes, Water from different sources.	Experimental, Observation	
3.	To study the different processes of pumping water (S).	Muddy water, Beakers, Funnel, Tripod stand Cotton, Alum.	Experimental, Observation.	
4.	To demonstrate the hardness of water obtained from different sources (D).	Samples of water from different sources, Test tubes, Soap solution.	Observation	
5.	To study water as a solvent (D).	Water, Test tubes, different soluble solids (sugar, common salt), liquids (glycerine, spirit), gases (CO_2), Lime water.	Observation	

2.4 Relevance to daily life

Water is the most abundant material available to man. Man can obtain water from a variety of sources. Water from different sources has some different properties, e.g., they may have different tastes due to varying amounts of dissolved substances, etc. Water from natural sources is not always pure. It contains many impurities which are harmful to man. These impurities need to be removed. We can even prevent water from becoming impure by covering the wells, by not cleaning dirty utensils or washing dirty clothes near the source of

water. Throwing the human, animal and other waste materials bathing ourselves and cleaning of animals near the source of water also make the water impure.

Conservation of water is also essential. We should not waste it and use it only when we need it.

3. EVALUATION

- (i) The students may explain why is it harmful to drink water from an open source ?
- (ii) Ask the students the reasons of water from some sources not forming lather with soap easily ?
- (iii) How can the students review the hardness of water?
- (iv) Explain the following terms .
 - a. Ground water,
 - b. Perennial river,
 - c. Hard and Soft water.

4. REFERENCE MATERIALS

1. Science, A text book for Secondary Schools, Part I, II—NCERT, New Delhi.

CHAPTER 14

ENERGY

1. OVERVIEW

The students already have idea of force, work and energy. They also know about simple forms of energy like heat, light, magnetic and electrical. They shall learn more about these forms of energy and also about other forms like nuclear, chemical and sound energies. In the next class they shall study in details about nuclear energy and its peaceful uses.

2. LEARNING OUTCOME

2.1 Key terms

Energy; Force, Work; Steam engine; Fuel; Transistor, Electric cell; Electricity; Kinetic energy; Potential energy; Chemical energy; Muscular energy; Sound energy; Magnetic energy; Nuclear (atomic) energy; Vibrations; Refinery.

2.2 Major ideas and explanatory notes

- (i) Energy is the capacity to do work or to exert force.
- (ii) Bodies in motion have kinetic energy.
- (iii) Bodies have potential energy due to their position or configuration.

Note :

When any body is kept at a height, it possesses potential energy due to the position (height) it is placed in. But when a spring or a catapult (*gulel*) is pulled or compressed, its overall position does not change but there is a change in its configuration (arrangement of one part with respect to the other). This also changes the potential energy of the spring or the catapult.

- (iv) Chemical energy is the energy produced due to chemical reactions.
- (v) Muscular energy is the energy possessed by the human beings, birds and animals.
- (vi) Sound, heat, light, electricity and magnetism also are different forms of energy.
- (vii) Fuels are sources of energy.
- (viii) Atoms are sources of very large energy. The teacher may note that when a nucleus of atoms splits (fission) or nuclei of two atoms fuse together (fusion) tremendous amount of energy is released. This is called nuclear energy or atomic energy. The process of fusion is responsible for the energy of the sun.
- (ix) Energy can be converted from one form into another
- (x) When energy is converted from one form into another, some energy is wasted.

2.3 Activities

S.No.	Title	Items required	Skills to be developed	Remarks
1	2	3	4	5
1.	To prepare a list of different sources of energy as seen in the immediate environment and to classify them as heat, light, sound etc. (S).	Paper, Pencil.	Observation, Classification.	Discussion with the students.
2.	To focus sunlight on a paper and observe changes (S).	Hand lens, Paper.	Observation, Inference.	—
3.	To add quicklime to a tumbler of water	Tumbler, Water, Quicklime,	Measuring temperature	

1	2	3	4	5
	to note the changes that take place in the temperature of the water (S)	Thermometer		
4.	To focus light on the bulb of a thermometer and to note rise of temperature (S).	Hand lens, Thermometer.	Observation, Inference.	Read thermometer accurately.
5.	To heat water using different sources of energy (D & S).	Electric heater Gas burner, Siggree, Candle.	Understanding that different sources give different amounts of heat.	The Water may be heated using sunlight if possible.
6.	To trace source of energy imparting motion to an inflated balloon (S).	A balloon	Understanding that balloon moves on the principle of the action and reaction.	The balloon shall not be tied to anything.
7.	To make a list of energy conversions in case of a glass marble released from some height (S).	Glass, Marble.	Observation, Reasoning and organisation.	Use hard floor as a base.
8.	To demonstrate the energy of moving water (D).	A tin with spout near bottom, A jet, Rubber tubing, Vanes prepared from light metal, Knitting needle and a cork,	Manipulation Observation, Inference.	

2.4 Relevance to daily life

Energy is an important concept in the life of a child. He knows that he needs energy for doing work and more of it is needed for strenuous work. All around, the child sees energy being used in its various forms. He sees that the sun is the main source of energy which it has been supplying for millions of years.

Energy resources are being depleted at a fast rate and the teacher can discuss some of the consequences of this and suggest how to save on energy.

3. EVALUATION

- (i) A rubber ball is allowed to fall from a height of about 1.5 metres on a hard smooth floor. The ball moves up and down. The students can be asked to observe its motion. The following questions may be asked in this situation :—
 - a. List the different forms of energy during its motion.
 - b. Does it rise to the same height every time ?
 - c. Do you hear any sound when the ball strikes the floor ?
 - d. Has the friction (of air) to do anything with its motion ?
 - e. How can it be connected with energy transformation taking place ?
- (ii) A very interesting toy (yo-yo) can lead to a similar situation which may be utilised to assess the achievement of the class.
- (iii) A lively discussion can be initiated in the class as to how the sun is the main source of energy on the earth.

4. REFERENCE MATERIALS

1. Physics—D. Halliday and R. Resnick, John Wiley & Sons, New York.
2. Physics, Foundations and Frontiers—G. Gamow and J.M. Cleveland, Prentice Hall of India (Private) Ltd, New Delhi.
3. Learning Science Through Environment, A textbook for Class V—NCERT, New Delhi.
4. Physics For Everyone—L. Landau and A. Kitaigorodsky, Mir Publishers, Moscow.

CHAPTER 15

MOTION, MASS AND FRICTION

1. OVERVIEW

By now the children are familiar with different types of motion and with some types of forces. They have also studied that a force is required to make a stationary object move and a moving object stop. They also know about the frictional force which causes hindrance in the motion of any object.

In the present chapter, the children will learn about uniform and non-uniform motion, speed and average speed. The concept of inertia in terms of mass, the measurement and units of mass, the difference between mass and weight are also dealt with to some extent. The concept of density of an object and its relative density have been introduced. It is shown that rolling friction is always less than sliding friction. The chapter also deals with the concept of action and reaction being equal and opposite.

The teacher may note that the concepts of uniform motion, inertia and action and reaction are all related to the Newton's laws of motion, but no explicit mention is made of them here.

The teacher may recapitulate the contents of chapter 5 before teaching this chapter.

2. LEARNING OUTCOME

2.1 Key terms

Motion and rest; Linear motion; Circular motion; Inclined plane; Uniform and non-uniform motion; Speed (km p.h., m/s); Average speed; Inertia; Mass (inertial); External force; Beam balance; Spring balance; Density and Relative density; Weight; Units of weight (kg.wt. g.wt.);

Gravity, Friction-rolling and sliding; Ball bearing and roller bearing;
Action and reaction;

2.2 Major ideas and explanatory notes

- (i) A feature of moving object is the distance travelled in unit time.
- (ii) When a body moves along a straight line so that it covers equal intervals (however small) of time, it is said to be in uniform motion.

Note ;

At this stage the teacher need not stress the idea of small intervals of time. When the distance covered in equal intervals of time is not the same, the speed is not constant and the motion is non-uniform. In this case we talk of average speed. It is given by total distance divided by total time taken to cover the distance

- (iii) The property of a body which helps it resist any change in its position (of rest or of uniform motion) when external forces are applied on it has a vital role to play. The mass (inertial mass) of a body is a measure of this property. It is measured in kilogram and its multiple and submultiple units in the MKS system of units.
- (iv) The mass of unit volume of a substance is another feature of it. It is expressed in Kg/m^3 . The teacher can show that the density of water is 1000 kg/m^3 with the help of an activity i. e. by measuring the mass of 1 litre (which is $1/1000$ of 1m^3) of water using a plastic bag and a spring balance.
- (v) The weight of an object is another property. It is the force with which the object is attracted by the earth.
- (vi) A force opposes the sliding motion of an object. The force of sliding friction depends on the weight of the object and also on the nature of the two surfaces.

Note ;

The teacher can demonstrate that sliding friction is different for different surfaces by measuring the force of friction for the same block, sliding on different surfaces, e. g. wood and glass plate.

- (vii) When a body rolls over another surface there acts another force of friction?

(viii) To every action there is an equal and opposite reaction. The teacher may elaborate this idea through example to build its logic.

2.3 Activities

S. No.	Title	Items required	Skills to be developed	Remarks
1	2	3	4	5
1.	To observe motion of objects and classify them as uniform and non-uniform (D & S).	Feeling of a pulse, rhythm in clapping, speed of a car or athlete.	Ability to observe motion and to distinguish between uniform and non-uniform motion.	
2	To determine the average speed (S).	A watch with seconds hand	Ability to calculate a long distance on the basis of average speed.	The Childrer may be aske to determine the average speed of their motien from home to school.
3.	To determine the density of kerosene oil (S).	Beam balance, Measuring cylinder/graduated container.	Use of beam balance and measurement of volume.	
4.	To determine the weights of different objects with help of spring balance (D).	Spring balance, Stone, Wooden block, School bag, etc.	Use of spring balance and familiarity with the units of weights.	

1	2	3	4	5
5.	To measure the force of sliding/rolling friction between two surfaces (D).	Spring balance, Wooden block, Glass and wooden surface, Pencils.	Measurement of force of friction.	
6.	To see in action the principle of 'action and reaction' (S).	A large balloon	Observation	The balloon filled with air when let go allows the air to rush out downward and the balloon rises upwards.

2.4 Relevance to daily life

This chapter helps to explain some common phenomena like why we feel a jerk when a bus starts or stops suddenly, why the fans keep running for some time even when the current is switched off etc. It also helps us in understanding why heavy loads require wheels for transportation.

3. EVALUATION

- (i) The teacher may discuss how one swims and bring out the principle of 'action and reaction'.
- (ii) The teacher may ask what will be the ratio of the inertias of two bodies of mass 30 kg, each moving with speeds of 15 km/hr and 10 km/hr respectively.

Note : The inertia is related only with the mass—its speed has no relevance.

- (iii) A car moves from a point A to B with a speed of 50 km/hr and returns from B to A with a speed of 40 km/hr. Calculate the average speed of the car.

Note :

Many children may give the answer 45 km/hr which is wrong. The answer is determined by calculating the total distance moved divided by the total time taken for the car to move from A to B and back.

4. REFERENCE MATERIALS

1. Physics for Entertainment—Y. Perelman, Mir Publishers, Moscow
2. Physics for Everyone—L. Landau and A. Kitaigorodsky Mir Publishers Moscow.

CHAPTER 16

PRESSURE AND BUOYANCY

1. OVERVIEW

The children have already been introduced to the concept of pressure on an object as being force acting on it perpendicularly per unit area.

In this chapter, this concept is applied to liquids and gases and some important properties of pressure are discussed. It is also shown that liquids exert an upward force on objects which are immersed in them. This force is related by Archimede's principle to the weight of the liquid displaced.

2. LEARNING OUTCOME

2.1 Key terms

Fluid (liquid, gas); Thrust ; Pressure ; Height of liquid column ; Stop-cock ; Oxygen cylinder ; Pascal's law ; Piston ; Transmit ; Hydraulic press ; Force of buoyancy ; Air bladder ; Submarines ; Overflow can ; Archimede's principle ; Float ; Hydrometer.

2.2 Major ideas and explanatory notes

- (i) The thrust and pressure of a liquid column depend on its height (or depth).

The teacher may note that the air pressure reduces as we climb a high mountain. The reason for use of oxygen cylinders on the high mountains is also same because the total amount of available oxygen gets reduced.

- (ii) The thrust exerted by a liquid column is equal to the weight of the column.

- (iii) A liquid tries to seek its own level.
- (iv) At any point liquids and gases exert equal pressure in all directions.
- (v) The pressure applied on a liquid or a gas is transmitted uniformly in all directions (Pascal's law).
- (vi) Buoyant force of a fluid is the upward thrust exerted by it on any object immersed in it.
This force on a body, immersed in a liquid, is equal to the weight of the liquid displaced by the body.
- vii) A denser liquid offers greater buoyancy than a less dense liquid.

Activities

o.	Title	Items required	Skills to be developed	Remarks
2	3	4	5	
	To Collect water from the holes of a tin(S).	An empty tin	To learn that volume of water collected from different holes depends upon the pressure at that hole.	
	To find out the thrust and pressure exerted by water(S).	Glass, Tin, Tea-cups of different diameters.	To acquaint the children that pressure will be different in the three containers although volume of water is the same.	
	To demonstrate Pascal's law using a rubber ball with holes(D).	Rubber ball	Pressure is transmitted equally in all directions.	

1	2	3	4	5
4.	To measure the buoyant force (D).	Spring balance, Metal cylinder, Beaker or any similar vessel, Measuring cylinder.	Observation	
5.	To measure the buoyant force in different liquids (D).	Water, Kerosene or mustard oil, and apparatus listed in above activity.	To understand that buoyant force offered by denser liquid is larger than that by the other liquid.	

2.4 Relevance to daily life

The knowledge of pressure exerted by liquids is very important in designing dams, ships or submarines. It helps us in understanding the means by which fish and whales can swim in water. Fountains and fountain pens as well as hydraulic presses also work on this principle. The principle is also made use of in constructing hydrometers for measuring relative densities of liquids.

The knowledge of air pressure is necessary to predict the weather and in designing aeroplanes, water pumps and vent-pipes for allowing air to escape from water tanks.

3. EVALUATION

- The teacher may ask the children to explain the working principle of fountain pen, *piehkarl* etc. by drawing suitable diagrams.
- An object of weighing 60 g. (in air), has volume of 50 cm^3 . When it is completely immersed in kerosene oil it weighs 20 g. Calculate the density of kerosene oil.

Note :

This problem may be a little difficult for the average child.

. REFERENCE MATERIALS

1. Physics—D. Halliday and R. Resnick, John Wiley & Sons, New York.
2. Inventions that Changed the World—Mir Najabat Ali, National Book Trust, New Delhi.

CHAPTER 17

HEAT AND ITS EFFECTS

1. OVERVIEW

The students are familiar with different forms of energy such as heat, light, sound, etc. This chapter aims at familiarising the students with the quantity of heat given to or taken from a substance and its measurement. It also enumerates the various effects produced by heat. This knowledge will be utilised in the next chapter on transfer of heat.

In this chapter, the concepts of specific heat and latent heat when a change of state takes place are discussed. The chapter also discusses the expansion of solids, liquids and gases on heating and this fact is made use of in constructing thermometers. Heat also causes chemical and biological changes in substances.

2. LEARNING OUTCOME

2.1 Key terms :

Heat ; Temperature ; Thermometer ; Incubator ; Celsius and Fahrenheit scale ; Specific heat ; Calorie ; Vaporisation ; Boiling and Melting point ; Crystallisation ; Solidification ; Evaporation ; Condensation ; Latent heat of fusion ; Latent heat of vaporisation ; Thermal expansion.

2.2 Major ideas and explanatory notes

- (i) The property relating to heat is the degree of hotness or coldness of an object. The temperatures at which water freezes and boils are taken as 0°C and 100°C respectively. It is worthwhile to tell the class that $^{\circ}\text{C}$ pertains to a particular scale named after a scientist Celsius.
- (ii) The quantity of heat required to heat a substance is proportional to the rise of its temperature and also to its mass.

Note :

Heat required to raise 1 g of a substance through 1°C helps in measuring the amount of heat gained or lost. The amount of heat needed to heat 1 kg of water through 1°C is defined as 1 kilo calorie.

- (iii) Some heat is required to change the state of a substance at its melting or boiling points without rise in temperature.
- (iv) A liquid also changes into its gaseous state at a temperature lower than its boiling point.
- (v) All substances expand on heating.
- (vi) Heat causes chemical and biological changes.
- (vii) The temperature at which the change of state takes place remains constant till the whole of the substance is changed into the other state.

2.3 Activities

S.No.	Title	Items required	Skills to be developed	Remarks
1	2	3	4	5
1.	To observe the effect of rubbing two pieces of different materials (S).	Two pieces of different materials such as cloth and a cardboard.	Sensation of temperature	This activity could also be done with two pieces of the same material.
2.	To determine the melting point of ghee/wax (D & S).	A Vessel, Ghee, Thermometer, Heating arrangement.	Use of a thermometer and determination of melting and boiling points.	If ice is available the activity can be done using it.
3.	To determine temperature at which change of state from a liquid to its gaseous state takes place (D & S).	A flask with cork, Thermometer, Heating arrangement.		This activity should better be performed with water, Oils sometimes catch fire.

1	2	3	4	5
4.	To show that solids, liquids and gasses expand on heating (D).	A nut, Screw, Heating arrangement, Flask, Cork, Capillary tube.	Children to have an appreciation of the observation that substances expand on heating	
5.	To study the amount of heat energy released by rubbing different substances (S).	Wooden block, Marble (Kuncha), Cloth.	Understanding that different materials do not release same amount of heat energy on rubbing.	Only one marble to be used as a body, It is a qualitative investigation only.
6.	To study the effects of heating two substances through the same temperature range (D).	Test tubes with holder, Measuring cylinder, Thermometer, Heating device, Water Match box, Sand.	To make students aware of the specific heat concept.	Time taken in two cases be noted.
7.	To determine the boiling point of water (D & S).	Test tube, Thermometer, Heating device.	Understanding that the temperature at which water boils is about 100°C.	

2.4 Relevance to daily life

The idea of temperature is important because it helps us to categorise the hotness or coldness of an object. The boiling and freezing points of water help us to fix the temperature scale. While making ice cream salt is added to lower the temperature of freezing point of ice. The property of evaporation is made use of in earthen pitchers.

The fact that substances expand on heating has many effects in daily life. The students are aware that sometimes when boiling water is put in an ordinary glass tumbler it cracks. When an iron rim is fixed over a wooden frame, the iron rim is first heated. There is a gap on the railway track between two rails for the same reason. The clinical thermometer is also based on the principle of thermal expansion.

3. EVALUATION

- (i) The teacher should ask the students to make a list of some common situations where they observe the expansion of substances due to heat.
- (ii) The students should be asked to use their knowledge of evaporation and latent heat to explain how (a) water cools in earthen pitcher ; (b) in summer a grassy plot becomes cool after water is sprinkled on it.
- (iii) The teacher should ask the students to list up some common biological effects of heat.

4. REFERENCE MATERIALS

1. Inventions that Changed the World—Mir Najabat Ali, National Book Trust, New Delhi.
2. Physics For Everyone—L. Landau and A. Kitaigorodsky, Mir Publishers, Moscow.

CHAPTER 18

TRANSFER OF HEAT

1. OVERVIEW

The students are by now familiar with the idea of heat and temperature. They also know the effects of heat in their day-to-day life. The present chapter gives the students an idea of the various modes of transfer of heat from one body to another. The children will learn that heat flows from a body at higher temperature to a body at lower temperature. There are three different processes by which heat transfer can take place: conduction, convection and radiation.

The children will also learn that metals are good conductors of heat whereas materials like wood, cloth, cardboard and paper are bad conductors of heat. Liquids in general and all gases are bad conductors of heat. In liquids and gases heat transfer is by convection. The heat of the sun reaches the earth by radiation.

2 LEARNING OUTCOME

2.1 Key terms

Transfer of heat; Conduction; Convection; Radiation; Mercury column, Molecular point of view; Good and bad conductors of heat; Radiator and absorber.

2.2 Major ideas and explanatory notes

- (i) The transfer of heat from one body to another is of three types. No movement of particles takes place in the case of solids. The conduction of heat varies in different solids. Another process of transfer of heat involves the movement of particles as in case of gases and liquids. Heat can also be transferred without the use of material medium.

- (ii) Black bodies absorb and radiate better than white and other coloured substances.
- (iii) Heat flows from a body at a higher temperature to a body at lower temperature.
- (iv) Generally metals are good conductors of heat and liquids and gases are bad conductors. Mercury, a liquid, however, is a good conductor.
- (v) The term 'mercury thread' instead of 'mercury column' is better understood in the case of thermometer.

2.3 Activities.

S.No.	Title	Items required	Skills to be developed	Remarks
1	2	3	4	5
1.	To distinguish between good and bad conductors of heat (S).	A source of heat, A metallic body (like a spoon) and a piece of asbestos or glass (test tube will also do).	Observing the transfer of heat in the case of a good and a bad conductor, Classifying the conductors as good and bad.	The body held in hand gets heated only in the case of a conducting material.
2.	a) To observe the phenomena of conduction (S). b) To compare the heat conductivity of two conductors (S).	Two similar metallic rods of equal size, Source of heat, wax, and nails as per textbook.	Observation of conduction of heat in metals.	The activity can be done using one rod.
3.	To observe convection of heat	Stand, Flask, Water, Potas-	Observation of convection of	

1	2	3	4	5
	in case of a liquid (S).	sium permanganate, Heating-device.	Observation of convection of heat.	
4	To observe radiation of heat(D).	Two thermometers one placed in the sun and the other in a shade.	Observation of rise in temperature.	a) Two similar thermometers should be used. b) Time for exposure should be same.

2.4 Relevance to daily life

In life there are several situations where we make use of the ideas dealt in this chapter. In winter dark dresses are preferred. Without the process of radiation, we will not receive any heat from the sun and there would be no life on earth.

In the kitchen there are substances of which some are good and some are bad conductors of heat.

3 EVALUATION

- The students should be asked to observe and explain why the cooking utensils used in homes are metallic and have wooden handles.
- The teacher should suggest the students to observe ventilators and explain their role.
- The students may be asked how the wollen clothes keep us warm in winter.

4. REFERENCE MATERIALS

1. Physics, A textbook for secondary schools—NCERT, New Delhi.

CHAPTER 19

LIGHT AND OPTICAL INSTRUMENTS

1. OVERVIEW

Although mirrors and even lenses are common in our daily life, the children may not have known much about them earlier. They have also not studied about the structure of eye.

The chapter deals with the images formed by plane and spherical mirrors as well as by lenses. The different types of images formed depending upon the position of the objects are discussed. The structures of simple optical instruments which use one or two lenses like telescope, microscope and camera are introduced. The structure of eyes of the man, animals and insects is also discussed in the chapter.

While discussing the passage of light through lenses, no mention of refraction is made here. It is made in chapter 33. Also, in this chapter, the details of ray diagrams of light are not to be stressed. The children will learn more about them in later classes.

2. LEARNING OUTCOME

2.1 Key Terms

Plane mirror ; Reflection, Transparent materials ; Transmission ; Absorbed ; Ray-streak apparatus ; Slit ; Point of incidence ; Normal ; Angle of incidence ; Reflected ray ; Angle of reflection ; Lateral inversion ; Image (Real, Virtual, Erect) ; Spherical mirror—concave and convex ; Surface of reflection ; Radius of curvature ; Centre of curvature ; Vertex ; Principal axis ; Focus ; Focal length ; Solar cookers ; Search lights ; Head lights ; Spherical lenses (double convex and double concave) ; Diverging

and converging lens ; Centre of lens ; Magnifying glass ; Compound microscope ; Magnification ; Objective lens ; Eye lens ; Telescope ; Light sensitive film ; Exposure ; Human eye ; Cornea ; Retina ; Eye ball ; Light sensitive nerves ; Rods , Cones ; Defects of vision ; Myopia or short sightedness ; Hypermetropia or long sightedness ; Spectacles ; Cataract (*motta-blind*) ; Opaque ; and transparent materials ; Binocular and monocular vision , 3-dimensional image : Compound eye ; Ultraviolet light.

2.2. Major ideas and explanatory notes

- (i) A ray of light striking the surface of any opaque object is transmitted back. When a ray of light passes through a transparent object the phenomena is called transmission of light.
- (ii) Different objects reflect, transmit and absorb different amounts of light.
- (iii) The reflection and refraction of light takes place as per the respective laws.

Note : The phenomenon in which 'right' of the object becomes 'left' of the image in the mirror is called lateral inversion. The image formed by a plane mirror is (a) erect ; (b) of the same size as that of the object ; (c) laterally inverted ; (d) virtual, and (e) the distance of the image from the mirror is same as the distance of the object from the mirror.

- (iv) The terms like focus and principal axis convey special meanings.
- (v) Focal length of the mirror is equal to half the radius of curvature.

Note : This fact is for information only. Rays incident from the focus after reflection at the concave mirror become parallel to the principal axis.

- (vi) The size and position of the image formed by a concave mirror depends upon the concave mirror.
- (vii) All the rays parallel to the principal axis diverge after reflection at the surface of convex mirror and appear to come from a point (focus) on the principal axis behind the mirror,

- (viii) The images formed are different in different positions of a convex mirror.

Note : Students are not expected to draw the ray diagrams at this stage.

Teachers can tell the students that when a ray of light passes from one medium to another transparent medium, it bends at the surface of separation of two media. This is called refraction. The phenomenon of refraction should not be explained in detail.

- (x) Lenses are basically of two types converging and diverging.
- (xi) The nature of the images formed by a convex lens depends upon the distance of the object from the lens.
- (xii) Convex lens acts as a magnifying glass when kept close to the object.

Note : A glass bead (spherical lens) is used in some low cost microscopes.

- (xiii) Two convex lenses can be used to produce a magnified image of small nearby objects (microscope) or far off objects (telescope).

Note : In real microscopes or telescopes there may be more than two lenses.

- (xiv) In photographic camera a real image of an object is formed on a photo-sensitive film using a lens.
- (xv) There are two common defects of human eye. Besides these in case of cataract the eye lens becomes opaque.
- (xvi) Human eye can distinguish different colours.

Note : Single image is seen by both the eyes of human beings and is called binocular vision.

Note : Knowledge about the eyes of animals in the chapter is just for information.

2.3 Activities

S No.	Title	Items required	Skills to be developed	Remarks
1	2	3	4	5
1.	To study the image formed by a plane mirror(S).	Plane mirror, Roman alphabets written on a piece of paper.	To understand the concept of lateral inversion.	
2.	To study the laws of reflection(S).	Source of light (beam), Mirror, Protactor and a scale.	Measurement of angle of incidence and angle of reflection.	
3.	To have an idea about the nature of image (size and position) formed by a concave mirror when object is placed at different positions along the principal axis(S).	Concave mirror with stand, Object, Candle, Screen and metre scale.	Determination of rough focal length of a concave mirror, Identification of nature of the image when the object is placed at different positions.	
4.	To determine the rough focal length of a convex lens and a simple study of the nature of image formed by it(S).	Convex lens and a screen (notebook). Convex lens, Metre scale, Candle, Screen.	Identification of the nature of image formed by convex lens for different positions of the object along the principal axis.	

1	2	3	4	5
5.	To prepare a model of a pin hole camera(S).	Cardboard box (shoe box), Tracing paper Black paper, Gum, Drawing pin, Blade or knife.	Understanding the working of a pin hole Camera.	

Note : The teacher may help the children in constructing a model each of (i) periscope and (ii) Kallidoscope using suitable pieces of plane mirror and card-board pieces or old boxes.

2.4 Relevance to daily life

Study of this chapter will help in appreciating the optical phenomenon of reflection from plane and curved surfaces and transmission through transparent substances. It will also help us to form an idea about some defects of human eye. Students will become aware of the fact that insects and animals have different types of vision other than human beings.

3. EVALUATION

- (i) The students may be asked to list various situations where they come across the phenomenon of reflection and to list common transparent substances.
- (ii) For certain angles of incidence, the students may be asked to tell the corresponding angle of reflection.
- (iii) The students should be asked to look for the situations/devices where lenses are used and then prepare a list of such devices/situations.

4. REFERENCE MATERIALS

1. Physics, Foundations and Frontiers—G. Gamow and J. M. Cleavland, Prentice Hall of India (Pvt) Ltd., New Delhi.
2. Physics for Entertainment, Parts I, II—Y. Perelman, Mir Publishers, Moscow,

CHAPTER 20

VIBRATING BODIES AND SOUND

1. OVERVIEW

The aim of this chapter is to acquaint the children with the production and propagation of sound. Attempt has also been made to make them aware of human ear - a organ which can detect different sounds but with limitations. The chapter also introduces echoes.

Although it is an independent unit, it is connected with the knowledge of speed, vibratory and periodic motions and phenomenon of reflection which is covered in the previous chapter. The knowledge acquired will form a background for learning more about sound waves and other related phenomena in higher classes.

2. LEARNING OUTCOME

2.1 Key terms

Sound ; Wave ; Vibrate ; Tuning fork ; Prong ; Compression ; Rarefaction ; Pitch ; Frequency range ; Vibrations per second ; Frequency range ; Ultrasonic ; Reflection ; Echo ; Absorption ; Gramophone ; Radiogram ; Groove ; Membrane ; Recording ; Reproduction of sound ; Horn ; Gramophone record/disc.

2.2 Major ideas and explanatory notes

- (i) Vibrating bodies produce sound.
- (ii) Sound can travel through different media.
- (iii) Sound travels faster in some media than others.

Note: In the textbook- 'Learning Science-Part II (1978 Edition)' chapter 20 under section 3.3 please correct speed of light to 300,000 Km per second.

- (iv) Sound can be reflected from certain surfaces.

Note: Echoes are produced when sound is suitably reflected. The teacher will need practice for demonstrating the echo of sound. This activity can also be used for finding out the distance of cliff or building from the observer if speed of sound is known or vice versa.

- (v) Different materials reflect sound to different extents.

Note: Porous materials are poor reflectors of sound because they absorb energy ; Sound produced by different bodies differ in pitch and loudness. Sounds can be detected by human ear but not of all frequencies. Sound of high frequencies (20,000 vibrations per second and above) are called *ultrasonic*.

- (vi) Sound can be recorded and reproduced.

Note: The devices like gramophone are used for the purpose.

- (vii) Human ear has a complicated mechanism and helps us to hear sounds of audible range (of frequencies 20 to 20,000 vibrations per second).

Note: The dogs and bats can detect frequencies above 20,000 vibrations per second. Dogs have helped in giving signals of volcanoes out burst. Bats produce and use high frequencies for getting echoes from their prey or bodies coming in their path while flying.

2.3 Activities

S.No.	Title	Items required	Skills to be developed	Remarks
1	2	3	4	5
1.	To observe sound produced by some vibrating bodies (S).	Tuning fork, Piece of thermocole, Thread, Rubber cork, Table, Metal-strip and 'Iktara' if possible.	Observation	Hearing different sounds and noticing vibrations in their sources.

1	2	3	4	5
2.	To study the propagation of sound through solids (S).	A long rod 'Lathi', Two tins, Long thread, Match sticks, Hammer.	Observation, Inference.	
3.	To study the propagation of sound through liquids (S).	A few balloons, Thread, Water.	Observation, Inference.	
4.	To study the propagation of sound through gases-air (S).	A bell or some other source of sound.	Observation, Inference.	
5.	To study the sound produced by a source vibrating at different frequencies (S).	Toothed-wheel arrangement, Stand, Metal sheet or a Cord-board piece.	Observation, Inference.	Noticing the difference in sounds of different frequencies.
6.	To observe the reflection of sound from certain surfaces(S).	Cylinder (1000 ml), A source of sound, Metal pieces, Plywood, Card-board.	Inference through observation.	
7.	To study the absorption of sound by certain porous materials like cork, thermocole, or thick cloth (S).	A piece of thermocole, Cotton cloth piece and items of activity No. 6.	Observation, Inference, Prediction.	It is out of class activity,

1	2	3	4	5
8.	To study the echo (S).	Two wooden blocks, Tall building or a cliff.	Observation, Inference, Prediction.	Intensity of sound must be such that it may reach you after reflection.
9.	To make a working model of 'Iktara' (S).	A suitable thin steel wire, Small empty tin, Wooden stick, Paper, Paste-material.	Application, Improvisation.	Discarded wires of <i>Sitar/Tanpura</i> .

2.4 Relevance to daily life.

This chapter has a great importance in our day-to-day life. Common experiences and observations such as '—doors and window-panes rattle during a thunder storm, a deaf has ears alright but cannot hear, should be utilized while teaching this topic. We all know that nature has designed the ear so that we can distinguish between sound of one friend from another, that of a male from a female's voice, music of one instrument from another.

Experiences about the reflection of sound in daily life of a child (from a deep well or inside a big empty hall or standing at some distance in front of a tall building) can be utilised for making the children understand the phenomena of echoes. The common experience of a few seconds time lapse between seeing a lightening flash and hearing the thunder of a cloud can be explained on the basis of speeds of sound and light.

The fact that sound can be recorded and later reproduced has helped the man for entertainment. Children can appreciate how the property of certain materials for absorbing more sounds has helped in avoiding echoes (speech and music in auditoriums or cinema halls can be enjoyed better when disturbance from reflected sounds is not there).

The property of solids or liquids to propagate sound can help one to know from a large distance whether a water pump at the pump-house is running or not by listening to its sound by keeping the ear in contact with the water pipe from the pump-house.

3. EVALUATION

- (i) A deaf and blind person may be able to tell whether a watch is working or not by keeping one end of a stick on the watch and other under his teeth. They may explain the principles involved in this process of getting the information.
- (ii) Students may be asked to list up some simple and common sources of sound such as school bell, cycle bell, call bell and electric bell and also list up the cause of sound against each.
- (iii) In a toy telephone words can be communicated between two friends over a large distance. What carries energy of sound in this case?

4. REFERENCE MATERIALS

1. Physics, A textbook for Secondary Schools, Classes IX-X—NCERT, New Delhi, Chapter on 'Wave Motion'.

CHAPTER 21

EFFECTS OF ELECTRICITY

1. OVERVIEW

The children are familiar with many situations where electricity is used. They find bulbs lighted in a bus and in other vehicles during night. Besides the use of dry cells in a handtorch or in some toys they also observe the electric mains being used. They know that a bulb lights up or a fan runs only when switched on. The aim here is mainly to acquaint the students with elementary components of an electric circuit. Using the dry cells students can also learn that it is the chemical energy stored in a cell that is converted into electrical energy. They will be introduced to heating, lighting, magnetic and chemical effects of electricity and they will be able to link up these with the working of some common electrical gadgets.

Though, there is no link with the previous knowledge, yet it needs be mentioned that pupils have been introduced to electrical and magnetic energy in class VI and will know more about electricity in class VIII.

2. LEARNING OUTCOME

2.1 Key terms

Cycle dynamo, headlight ; Switch ; Dry cell ; Chemical effect ; Heating effect ; Magnetic effect ; Electrical circuit ; Magnetic needle ; Electric current ; Conductor, Source of electricity ; Positive & negative terminals ; Insulator ; Continuity ; Appliance (gadget)

2.2 Major ideas and explanatory notes

- (i) An electrical circuit has some requisites.

(ii) The electric current finds way through conducting wires.

(iii) Flow of electric current produces some effects.

Note : The teacher may point out that one or more effects are produced at a time; the effects are heat, light, magnetic and chemical.

(iv) There are some sources of electricity.

Note : Although a mention of different sources of electricity has been made in this chapter only a safe source (dry cell or a set of dry cells) is to be used. Children must know a lot more about electricity before they can learn about electric mains.

2.3 Activities

S.No.	Title	Items required	Skills to be developed	Remarks
2	3	4	5	
1.	To study an electric circuit(S).	A dry cell, Torch bulb, Socket, Connecting wires.	Making a simple circuit, identification of its components.	Students must learn proper use of a dry cell.
2.	To observe that heat is produced when current passes through a certain wire (S).	Suitable Nichrome / Copper wires, 2 dry cells, Connecting wires and a pencil.	Observation of heating effect of electric current, Inference.	Source of electric current may preferably be dry cells.
3.	To observe that heat and light are produced when current passes through fine wires of a bulb(S).	A torch bulb working on 2/3 dry cells, Bulb, Socket, Connecting wires.	Observation of lighting effect of current, the use of two or more cells in series.	Children must learn use of 2 and 3 cells in series.

1	2	3	4	5
4.	To observe that the magnetic needle is deflected when placed under a current carrying conductor(S).	Magnetic needle, Copper wire Key, and source (dry cell).	Observation of magnetic effect.	
5.	To observe that the electric current causes chemical effect. (D & S).	2 dry cells, Copper sulphate solution, Two copper plates, Key and connecting wires.	Observation of chemical effect.	
6.	To observe the inside of a used up dry cell (S).	Dry cell (used up) and a hack-saw blade or a knife	Identification of the components of a cell.	
7.	To observe commonly used electric wires(S).	Different types of connecting wires—single, two and three-core.	Observation of insulators and conductors in the connecting wires.	

2.4 Relevance to daily life

This topic is very closely related to the daily life of a child. Ours is an age of electricity and it is being utilized to make our lives comfortable and easier. The children see lighting effect of current whenever they see a lighted electric bulb/tube in a house or on a road. Sometimes a child observes the use of insulators whenever he finds rubber gloves being used by electricians handling electric mains

Children need be warned against playing with mains as an electric

shocks can be fatal. The children observe that dry cells after use are discarded. They may be made aware that this is because of the fact that the chemical energy of the cell was converted to electrical energy. The teacher may, if he likes or if some student raises a question, discuss further that a bus or a motor cycle uses a battery which can be recharged (re-energised).

3. EVALUATION

- (i) Students should be asked to list up and describe appliances which use heating, lighting, magnetic and chemical effects of electricity.
- (ii) Students should be asked to test the condition of a dry cell with a simple circuit, using a torch bulb.
- (iii) Students may be asked to improvise a hand torch.

Note : A 1-2V electric bulb (unfused) goes well with one dry cell.

4. REFERENCE MATERIALS

1. Physics, A textbook for Secondary schools, Classes IX-X—NCERT, New Delhi, Chapter on Magnetism and Electricity.

CHAPTER 22

ELECTRICAL CHARGES AT REST

1. OVERVIEW

The chapter covers the properties of the static electric charges. Some bodies can be electrically charged by rubbing with certain other bodies. These charges are of two kinds- 'positive' and 'negative'. The main property of these charges is that the like charges repel each other while the unlike charges attract each other.

An understanding of the electrostatics helps one to know facts about lightening phenomena seen during a thunder storm.

In this chapter use of some low-cost materials like thermocole (the packing material in common use) and plastic (say a plastic scale or pen) has been suggested in place of ebonite and glass rods used traditionally for producing electrostatic charges. Thermocole can be rubbed by a piece of woollen-cloth or even with paper and charged easily in any climatic conditions. The electroscope suggested is also low-cost and efficient.

2. LEARNING OUTCOME

2.1 Key terms

Electrostatics; Frictional electricity; Electric spark; Electric charges, positive and negative; Like and unlike charges; Lightening; Electroscope; Conductor; Insulator; Lightening conductor; Earthing; Letting off the charge.

2.2 Major ideas and explanatory notes

- (i) Certain bodies can be charged electrically by rubbing with others.
- (ii) Electric charges are of two kinds—positive and negative.
- (iii) Like charges repel each other and unlike charges attract each other.
- (iv) When two bodies are charged by rubbing together both of them get charged but with opposite charges.
- (v) The bodies allow the charge to pass through them.

Note: The bodies through which the charge passes are called electrical conductors, and which do not allow the charge to pass are known as electrical insulators.

- (vi) Lightening in the clouds occurs when an electric discharge takes place between two oppositely charged clouds or between clouds and a tall object.

2.3 Activities

S. No.	Title	Items required	Skills to be developed	Remarks
1	2	3	4	5
1.	To charge the body by rubbing (S).	A plastic comb or pen, Small bits of paper or a dry grass ear, Thread.	Observation, Inference.	
2.	To demonstrate the attraction and repulsion between the charged bodies (D).	Two test tubes, Two plastic scales, Piece of woolen cloth, Thread, An insulated stand,	Observation, Inference.	

1	2	3	4	5
3.	To demonstrate that both the bodies rubbed together get electrified but with opposite charges (D).	Two plastic scales, Piece of woolen cloth, Thread, An insulated stand.	Observation, Inference	Students need infer from the observations that :— (i) two bodies rubbed together get electrified and, (ii) charges acquired by both are opposite to each other.
4.	To demonstrate (i) charging a body by simple contract with a charged body and (ii) charge acquired by the uncharged body is same as that of the charged body (D).	Paper cylinder, Thread, A charged body.	Observation, Inference.	
5.	To demonstrate that— (i) charge flows through a conductor, and (ii) Insulator does not allow the charge to flow (D)-	Two simple electroscopes, Metal wire with handle, A charged body with an insulated handle.	Observation, Inference.	

Note : To be sure of the activities, it is better to warm up ebonite and glass rods and even thermocole and plastic scales besides the cloth piece to be used. Moreover, it is advisable to test the activities before performing them in the class.

2.4 Relevance to daily life

Some common observations and experiences connected with the frictional electricity can be well appreciated by the children after a knowledge of the ideas covered in this chapter. For example the lightening conductor provided on tall buildings, the sparks seen in the dark while putting off a nylon dress and the metallic chain hanging and touching the road at the back of the trucks for grounding the electrostatic charge developed by truck's body while moving at high speed over long distances.

The children will also learn about the need for taking care to protect themselves from lightening if caught unaware in the open during a thunder storm.

3. EVALUATION

- (i) Students should be asked to list up the common situations involving frictional electricity.
- (ii) Students may be asked to relate their experiences of simple activities done by them for charging some common objects like a plastic pen and to check if the object gets charged (a dry grass-ear suspended with a thread from a pencil can be used for checking charge on a body).
- (iii) Students may be asked what they will do if caught unaware in the open during a thunder storm.

4. REFERENCE MATERIALS

1. Physics, A textbook for Secondary Schools, Classes IX-X—NCERT, New Delhi, Chapter on Electricity.

CHAPTER 23

MAGNETISM

1. OVERVIEW

At this stage children show in knowing main features and common uses of a magnet.

Some children have experience of playing with some toys using magnets and might have become interested in knowing the magnets. If the school does not have some magnets, the teacher may use a new stainless steel shaving blade as a magnet (a weak magnet). It can be floated on water and so can a sewing needle. Thus some properties of a magnet can easily be observed.

2. LEARNING OUTCOME

2.1 Key terms

Magnet; Magnetic pole—North South; like and unlike; Magnetic attraction and repulsion, Magnetic substance; Non-magnetic substance; Magnetic compass; Single touch method of magnetisation.

2.2 Major ideas and explanatory notes

- (i) A strong magnet attracts iron filings.

Note :

The filings mostly cling to the ends of the magnet; these ends are called its poles.

- (ii) When suspended freely a magnet takes nearly the north-south direction

Note :

This is because earth behaves like a huge magnet with its N-pole near the geographical south pole and vice versa.

- (iii) Unlike poles of two magnets attract each other and their like poles repel each other.
- (iv) Some materials (like iron) are attracted by a magnet while the others are not.
- (v) A temporary magnet can be made by rubbing properly a soft iron piece with a strong magnet. Such magnetism is lost by heating the magnetised iron piece or even by mishandling it.

Note :

At this stage the terms para-magnetism and dia-magnetism have been avoided and need not be dealt in the class.

2.3 Activities

S. No.	Title	Items required	Skills to be developed	Remarks
1	2	3	4	5
1.	To find out North and South directions using a magnetic compass(S).	Magnetic compass or a magnet, Thread and a piece of chalk.	Observation and skill of using a compass for finding direction.	
2.	To classify some common substances as magnetic and non-magnetic (S).	Magnet, Pieces of wood, Plastic, Glass, Papers, Iron.	Use of a magnet to observe its effect on common substances and inference.	

1	2	3	4	5
3.	To make a magnet (S).	A small piece of soft iron and a strong magnet.	Making a temporary magnet (by single touch method).	
4.	To observe that attraction is minimum near the poles of a magnet (S).	A strong magnet & iron filings or small iron nails.	Use of a magnet and identification of its poles.	
5.	To observe the effective distance of a magnet (S).	A strong magnet and a magnetic compass.	Observation	A strong magnet's effective distance will be about a metre.

Notes :

1. Demonstration of some damaged/open magnetic toys/models will motivate students.
2. Alnico magnets or the low-cost (ceramic) strong magnets should be used as permanent magnets.
3. Magnets should be kept carefully when not in use (Keepers should be used for keeping a pair of magnets and also for a horse-shoe magnet).

2.4 Relevance to daily life

A magnet is used for testing whether a coin is base or genuine. Magnets are used in some toys and also for holding the office-pins. They are used in several electrical instruments. Knowledge about magnetic and non-magnetic substances is helpful in life. A non-magnetic watch may not be affected by a magnet.

3. EVALUATION

- (i) The students should be asked to list a number of common substances as 'magnetic' or 'non-magnetic'. (Through actual observation of the effect of a magnet on the substance).
- (ii) Test student's knowledge about use of magnetic compass for finding out the direction.
- (iii) Students may be asked to prepare a magnet by rubbing a soft iron nail with a strong magnet and to test the polarity of the magnet so made by using a compass.

4. REFERENCE MATERIALS

- 1. Physics, A textbook for Secondary Schools, Classes IX-X—NCERT, New Delhi, Chapter on Magnetism.
- 2. Physics, A textbook for Higher Secondary Schools, Classes XI-XII—NCERT, New Delhi, (Chapters 13, 14 and 16).
- 3. Inventions that Changed the World—Mir Najabat Ali, National Book Trust, New Delhi.

CHAPTER 24

NATURE AND COMPOSITION OF SUBSTANCES—I

1. OVERVIEW

The children have some knowledge of matter and its three different states, namely, solid, liquid and gas. They will learn more and are expected to know more about the molecular nature of substances and role played by the molecules in determining some of the physical properties.

The chapter also deals with some special types of chemical reactions and covers the symbols and atomic masses of elements. The atomic theory of Dalton is also mentioned here.

2. LEARNING OUTCOME

2.1 Key terms

Atomic mass; Brittleness; Carbon unit; Chemical reaction; Combination; Decomposition; Diffusion; Elasticity; Electrolysis; Plasticity; Symbols.

2.2 Major ideas and explanatory notes

- (i) Molecular nature of substances.
- (ii) Forces between molecules.

Note :

In a solid the molecules are held very close to one another by strong attractive forces which are overcome by the increased motion of the molecules in a liquid state. In gases the forces of attraction are negligible.

- (iii) Gap between molecules.
- (iv) Movement of molecules.
- (v) Concept of chemical reaction and conditions.

Note :

The process in which a substance undergoes a change under certain conditions and new substances are formed is called chemical reaction.

- (vi) The chemical reactions are of different types.

Note :

- (a) Decomposition—By heating one substance gives rise to more substances.
- (b) Electrolysis- Two new substances are formed on passing current.
- (c) Combination - Two substances combine together to form new substances.
- (vii) Symbols and their uses.

Note :

Symbol denotes one atom of that element as well as represents its atomic mass.

- (viii) Atoms have a mass called atomic mass.
- (ix) Atoms are indestructible and cannot be created,
- (x) Atoms of a particular element are all alike.

2.3 Activities

S. No.	Title	Items required	Skills to be developed	Remarks
1	2	3	4	5
I.	To show the differences of inter-molecular space in	Three beakers, Clay/ glass/ wooden beads, Water,	Observation	

1	2	3	4	5
	a gas, liquid and a solid(D).	Salt and sand.		
2.	To study the elasticity and plasticity of substances (S).	Rubber band, Iron, Aluminium strips, Copper wire.	Experimental and Observation.	
3.	To show the decomposition of copper carbonate (D).	Heating device, Hard glass, Delivery tube, Test tube, Iron stand, Tripod stand, Lime water.	Observation	
4.	To show the electrolysis of water (D).	Conical flask, Rubber stopper, Two big nails, Cell-holder, Three cells, Two test tubes, Connecting wires.	Observation	

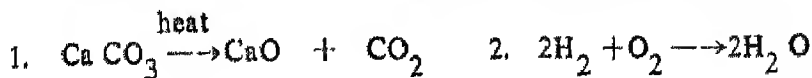
2.4 Relevance to daily life

Knowledge about the properties of matter has helped us to change the properties of substances by special treatment. For example, bricks and all vessels made of soil are hardened by burning. Glass by special treatment can be made to bear high temperature, metals can be moulded into various shapes by making them soft by heating.

Various chemical reactions are occurring around—changing of rocks due to action of water and air, catching fire by trees and other objects when struck by lightning.

3. EVALUATION

- (i) Why do liquids flow while solids do not flow ?
- (ii) When a balloon filled with water is pressed, it bursts, but a balloon filled with air does not ? Why ?
- (iii) Identify whether the following are decomposition reactions.



4. REFERENCE MATERIALS

1. Science, A textbook for Secondary Schools, Parts I-II—NCERT, New Delhi.

NATURE AND COMPOSITION OF SUBSTANCES—II

1. OVERVIEW

The children are familiar with the molecular nature of substances and chemical reactions such as decomposition and combination.

Pupils are expected to learn the following concepts : Law of conservation of mass, Valency - its use for writing chemical formulae and chemical equations.

2. LEARNING OUTCOME

2.1 Key terms

Conservation of mass; Chemical equation; Chemical formula; Valency.

2.2 Major ideas and explanatory notes

- (i) Law of conservation of mass - Atoms of the substances in a chemical reaction can neither be created nor destroyed.
- (ii) The molecular formula of a substance can be represented by symbols.
- (iii) The combining capacity of atoms.
- (iv) Valency can be determined from the formula.
- (v) The chemical reactions are represented with the help of chemical formulae.
- (vi) Writing and balancing of chemical equations.

2.3 Activities

S. No.	Title	Items required	Skills to be developed	Remarks
2		3	4	5
1.	To demonstrate the conservation of mass during mixing (D).	Beaker, Sugar, Water, Balance, Weight box, Glass rod.	Observation	
2.	To determine the percentage of copper and oxygen in cupric oxide (D).	Boiling tube, Test tube holder, Balance, Weight box, Cupric oxide, Heating device.	Observation	

2.4 Relevance to daily life

The law of conservation of mass is practically applicable in our daily life situations. When we assemble a complicated object by using several parts, the total mass of the parts is always equal to the mass of the object.

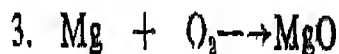
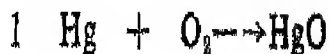
We need food-stuffs to get energy. The food material reacts with the digestive juices and water within the body to form materials required for building body and supplying energy. The residual material and water is excreted by the body. If all the reactants and products could be weighed by any means, we will find out that the total mass of the food stuff which we are consuming and the products formed are equal.

3. EVALUATION

- (i) From the following formulae find the valency of the constituent elements ; given that valency of oxygen is 2, chlorine is 1.



(ii) Balance the following equations :



4. REFERENCE MATERIALS

1. Science, A textbook for Secondary Schools, Parts I, II—NCERT, New Delhi.

CHAPTER 26

AIR AND OXYGEN

1. OVERVIEW

We are familiar with the idea that "air is present everywhere around us" and it helps in burning and respiration. The children will learn the atmosphere and the composition of air. The methods for preparation of oxygen and its properties along with its importance for living beings and in industry have been dealt in this chapter.

2. LEARNING OUTCOME

2.1 Key terms

Atmosphere; Humidity; Oxides—acidic and basic; Rusting; Slow oxidation.

2.2 Major ideas and explanatory notes

- (i) Composition and constituents of air.

Note :

Oxygen and nitrogen are present in the ratio of 21 : 78 along with other substances.

- (ii) Preparation, properties and uses of oxygen.
(iii) Oxides.
(iv) Oxygen is important for living beings and industry.

Note :

Oxygen is used in oxyacetylene flame for welding metallic plates and cutting heavy iron beams etc. It is also used in produc-

tion of acids and other important chemicals. Oxygen is used in hospitals, in under water diving, mountaineering, space travel etc. Liquid oxygen is used for producing low temperature.

2.3 Activities

S. No.	Title	Items required	Skills to be developed	Remarks
1	2	3	4	5
1.	To determine the percentage of oxygen in the air(S).	Candle, Gas jar, Match box, Water trough	Experimental and observation.	
2.	To observe the effect of blowing exhaled air into lime water (S).	Test tubes, Lime water, Glass rod.	Experimental and observation.	
3.	To observe that oxygen is released by green aquatic plants (S).	Beakers, Funnel, Test-tubes, Hydrilla, Match box.	Experimental and observation.	
4.	To prepare oxygen and study its properties (D).	Potassium permanganate, Boiling tube, Magnesium ribbon, Delivery tube, Trough, Iron stand, Heating device.	Observation	

2.4 Relevance to daily life

Oxygen is the most important constituent of air. Rusting of iron, a very common phenomenon, is due to oxygen of the air in presence

of a little moisture. Rusting is prevented by coating the iron surface by suitable paints. Oxygen is essential for living beings because it is required for respiration. Oxygen is also used in industry, hospitals, mountaineering and by spacemen while in space.

3. EVALUATION

- (i) The teacher may ask the students why do balloons filled with hydrogen gas go up in the air.
- (ii) Students may be asked to describe the method of preparation of oxygen and its properties.
- (iii) Students may explain how oxygen is important for them as well as of the living beings and also industry.

4. REFERENCE MATERIALS

- 1. Science, A textbook for Secondary Schools, Parts I, II—NCERT, New Delhi.

CHAPTER 27

WATER

1. OVERVIEW

The children already know about the existence of water, its usefulness in life, harm caused by impure water, the need to consume water, and the need to conserve water. They also know about hard and soft water. They will know water as a solvent.

In this chapter they will also study the solubility of substances (solids, liquids and gases) in water. The composition of water has also been discussed. The preparation, properties and uses of hydrogen and the processes of oxidation and reduction are also dealt with.

2. LEARNING OUTCOME

2.1 Key terms

Aqueous solution ; Chemical composition ; Dissolution ; Immiscible ; Miscible ; Partially miscible ; Oxidation ; Oxidising agents ; Reduction ; Reducing agents ; Solution ; Saturated solution ; Solute ; Solvent ; Suspension ; Unsaturated solution.

2.2 Major ideas and explanatory notes

- (i) Water is most abundant on the surface of earth.
- (ii) Water is a solvent.
- (iii) Substances dissolve in water.

Note :

The dissolution of a substance in water involves the detachment of molecules from the substance which results in greater freedom of movement.

- (iv) Solid substances have solubility in water.
- (v) Solutions can be saturated or unsaturated.

Note :

When no more of a solute can dissolve in a solvent at a particular temperature is called saturated solution but if more of the solute can be dissolved at that temperature, the solution is termed unsaturated.

- (vi) Based on the solubility in water the liquids are classified.

Note :

Liquids are divided into miscible, partially miscible, immiscible depending on their ability to dissolve in water.

- (vii) Solubility of gases in water.
- (viii) Composition of water.
- (ix) Preparation of hydrogen and study of its physical and chemical properties.
- (x) Oxidation and reduction reactions.
- (xi) Hydrogen in nature and its important uses.

2.3 Activities

S. No.	Title	Items required	Skills to be developed	Remarks
1	2	3	4	5
1.	To prepare a saturated solution of	Beaker (tumbler), Sugar, Salt,	Experimental, Observation,	

1	2	3	4	5
	sugar, common salt and alum (S).	Alum, Glass rod (spoon).		
2.	To study an oxidation reduction process (D).	Copper oxide, Charcoal, Boiling tube, Spirit lamp, Test tube holder.	Observation	
3.	To prepare hydrogen gas and study some of its properties (D).	Zinc, Sulphuric acid (dil), Kipps apparatus.	Observation	Improved Kipps apparatus provided in the kit.

2.4 Relevance to daily life

Water is present in all the food-stuffs and living organisms. Human body contains 75% of water. Water has great ability to dissolve many substances (solids, liquids and gases). We use aqueous solutions of various substances in our daily life and also in industry. Ability of oxygen to partially dissolve in water is very important for survival of living organisms found in water. Oxidation is responsible for several activities taking place in our body. Oxidation and reduction occur simultaneously. Hydrogen is present in the combined form in nature and is present in all the food stuffs. It is used for filling balloons and also for weather observations. Balloons filled with hydrogen are flown from Hyderabad to study cosmic rays.

The hydrogen is used for making oxy-hydrogen torch used for cutting and welding purposes. This gas is also used for preparation of vanaspati ghee, margarine, ammonia gas, fertilizers etc.

3. EVALUATION

Following questions may be put to the students.

- (i) If oxygen was insoluble in water how would the aquatic life be affected by it ?
- (ii) If water is collected from different sources like ponds, river, tap etc what will be ratio of hydrogen and oxygen in it ?

4. REFERENCE MATERIALS

1. Science, A textbook for Secondary Schools, Parts I, II—NCERT, New Delhi.

CHAPTER 28

ACIDS, BASES AND SALTS

1. OVERVIEW

The children have tasted some fruits which are sour. They are also familiar with substances of common use e.g. soda-bi carb, sodium chloride, copper sulphate, potash alum, soaps and detergents. They are aware how goldsmith cleans gold ornaments with acids. They also know about hard and soft water and the process of distillation.

The children will learn more about acids, bases and salts, soaps and detergents and their application.

2. LEARNING OUTCOME

2.1 Key terms

Acidic ; Basic , Amphoteric oxides ; Acids ; Bases ; Salts ; Alkalies ; Neutralisation, Detergents.

2.2 Major ideas and explanatory notes

- (i) Elements burn in the presence of oxygen to form substances (oxides).
- (ii) The oxides are of different types.

Note :

Non-metals form acidic oxides. These oxides are soluble in water, turn blue litmus red, react with bases to form salt and water.

Metals form basic oxides. These oxides are soluble in water, turn red litmus blue, react with acids to form salt and water.

The *oxides*, which react both with acids as well as bases, to form salt and water are called *amphoteric oxides* e. g. Aluminium Oxide (Al_2O_3), Zinc Oxide (ZnO), etc.

- (iii) The substances exhibit different properties.

Note .

Acids

- (i) have sour taste,
- (ii) change the colour of blue litmus to red,
- (iii) contain replaceable hydrogen atoms in their molecules,
- (iv) react with metals with the liberation of gas,
- (v) react with carbonates to evolve carbon-dioxide,
- (vi) are corrosive.

Note .

The teacher may advise the children to always add sulphuric acid in well-stirred water and never add water to sulphuric acid.

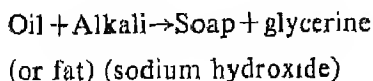
Bases

- (i) have bitter taste,
- (ii) have soapy touch and injure skin,
- (iii) turn red litmus blue,
- (iv) give pink colour with phenolphthalein.

The bases which are soluble in water are called *alkalies* e.g sodium hydroxide, potassium hydroxide. *Neutralisation* . The reaction between an alkali and an acid, with the formation of salt and water is called *neutralisation reaction*.

Salt. It is formed by the neutralisation reaction of an acid with a base.
Soaps and detergents.

The fats and oils are the starting material.



Some soaps do not form good lather and lack cleaning ability. To get rid of this difficulty, the substances called *detergents* are introduced. Detergents are better cleaning agents. They are also known as 'Soapless soaps'.

2.3 Activities

S. No.	Title	Items required	Skills to be developed	Remarks
1	2	3	4	5
1.	To study some properties of acids (S).	Sulphuric acid, Marble chips, Blue litmus paper, Zinc pieces, Test tube, Sodium hydroxide.	Experimental, Observation	
2.	To study some properties of bases (S).	Sodium hydroxide, Red litmus paper, Test tube, Sulphuric acid, Copper sulphate.	Experimental, Observation	
3.	To demonstrate the neutralisation reaction (D).	Dilute hydrochloric acid, Glass dish, Red and blue litmus paper, Sodium hydroxide solution.	Observation	

2.4 Relevance to daily life

Acids, bases and salts are substances of common use. Goldsmith uses nitric acid for the purification of gold, etc. Alkalies are used for the manufacture of soaps.

Sodium chloride (NaCl), Sodium bi-carbonate (NaHCO_3), Copper sulphate (CuSO_4) and potash alum are used for various purposes e.g. in cooking, preservation of foodstuffs, baking, as fungicides and in electroplating and purification etc.

Soaps and detergents are commonly used as cleansing agents.

3. EVALUATION

The teacher may ask the students the following :

- (i) How does sodium react with water ?
- (ii) Explain the changes that occur when concentrated sulphuric acid is slowly poured in well stirred water.
- (iii) Explain the changes that occur when water is added to a few pellets of sodium hydroxide kept in a beaker and is stirred with a glass rod. How do you feel when you rub a few drops of the above solution with the fingers ?
- (iv) How are salts obtained ?
- (v) How can you prepare soap ?

4. REFERENCE MATERIALS

1. Science, A textbook for Secondary Schools, Parts I, II—NCERT, New Delhi.

CHAPTER 29

PRESERVATION OF SELF-I

1. OVERVIEW

The children know that all living organisms grow and it is one of the fundamental life processes for which they require food. In this chapter they will learn more about how organisms get food which provides energy for various metabolic activities in the processes like respiration and circulation. Animals are directly or indirectly dependent on plants for their food, whereas most of the plants make their own food. The children will also learn about the various systems of higher plants and animals for performing various metabolic activities like digestion, respiration and excretion. The children will realise how the knowledge help us for better living and also for better care of other organisms.

2. LEARNING OUTCOME

2.1 Key terms

Organic matter ; Secondary consumers ; Chlorophyll, Decomposers ; Photosynthesis; Ingestion, Insectivorous plants; Absorption; Traheia ; Operculum ; Food balance ; Egestion ; Primary producers ; Digestive system; Primary consumers; Metabolic activities; Respiration; Vascular bundle, Tissues ; Venation ; Exchange of gases ; Oxalate crystals ; Cytoplasmic streaming, Cystolith; Phloem; Xylem , Stomata ; Artery ; Ureter , Urinary bladder

2.2 Major ideas and explanatory notes

- (i) All living organisms grow.
- (ii) They require food and energy to carry out various life processes.
- (iii) Green plants prepare their food by photosynthesis.
- (iv) Animals procure their food in different ways as they are unable to prepare it by themselves.
- (v) Some organisms get their food from decaying organic matter.
- (vi) The organisms are categorized on the basis of type of food they take.
- (vii) The digestion of food inside the body involves several steps.
- (viii) The organisms get energy from the food by respiration which involves exchange of gases.
- (ix) The absorbed food and gases are transported to various parts of the body by an internal transport system.
- (x) The undigested food and other waste products are thrown out of the body.

Notes :

1. Teacher may explain the different processes of growth, e.g. growth of an organism is biological, growth of pile of chips is mechanical and growth of a crystal is chemical. In animals during childhood growth is faster while its rate slows down during adolescent stage. In plants there are seasonal variations of growth. Some plants grow fast in summer, some in winter and others in spring season.
2. All green plants manufacture their own food in the presence of sunlight by using carbon dioxide and water with the help of green pigment called chlorophyll. There are other pigments found in plants. For comparison the teacher may give the example of fungi as non-green plants. Teacher should stress on the point that photosynthesis is

only possible where chlorophyll is present. Root being a nongreen part of a grass cannot photosynthesise.

3. Teacher may explain the mode of procuring food in *amoeba*. The absorption of food in this case is through the general surface of the body. The interesting example of insectivorous plant (pitcher plant) may also be explained. The body of the pitcher has sensitive hairs directed downward. When the insect lands in the pitcher the lid closes automatically and insect is not able to come up.
4. Carbohydrates are 'burnt' to give energy. 'Burnt' has to be explained in chemical terms 'oxidation of sugar'.
5. Building up of new cells from other living objects means the assimilation of food substances provide nutrition to the body cells which result into division and growth.

2.3 Activities

S.No.	Title	Items required	Skills to be developed	Remarks
1	2	3	4	5
1	To list the common parasites of the locality (S).	Charts	Observation	Students may classify plant and animal parasites.
2	To study respiration in germinating seeds and test for carbon dioxide (S).	Test tube, Cork, Small test tube, Thread, Lime water, Germinating seeds.	Setting up of apparatus, Observation.	Seeds like gram, moong germinate quickly.
3	To demonstrate blood circulation in the mesentery	Dissection box, Paraffin wax, Tray, Cotton,	Dissection, Observation.	Teacher may tell the names of various tools

1	2	3	4	5
	and heart beat of frog (D).	Timer, Alpins, Chloroform, Living frog.		in the dissection box.
4	To determine the pulse rate (S).	Timer or Wrist watch	Counting	Students may find out pulse rate of their friends before or after exercise.
5	To observe the vascular bundles in transverse section of stem (D & S).	Chart, Cucurbita, Maize stem.	Observation	Teacher may also show how the sections of plant materials are cut.
6	To observe the feeding activity of ants (S).	Petri dish, Sugar, sand, Ants.	Observation	Teacher may help in setting up the experiment.
7	To observe stomata in leaf peelings (S).	Forceps, Glass slide, Watch glass, Succulent leaves	Mounting, Observation.	The teacher may demonstrate before the students do it themselves.
8	To show that oxygen is released during photosynthesis (D).	Beaker, Funnel, Test tube, Water, Hydrilla plant.		Other aquatic plants small in size can also be taken.
9	To show that chlorophyll is necessary for photosynthesis (D).	Paper, Glass slides, Alcohol, Iodine, Variegated leaf.	Setting up of apparatus, Observation.	

1	2	3	4	5
10	To show that light is necessary for photosynthesis (D).	Black papers, Iodine, Potted plant.	Setting up of apparatus, Observation.	Black cloth can also be used.

2.4 Relevance to daily life

We observe that all living animals have to take food for their survival. Plants cannot grow if they are deprived of water, sunlight and air. We feel hungry when we go without food for several hours. Inhaling and exhaling air—a part of respiratory process in human beings can be easily observed. The food is most essential factor for continuing the metabolic activities in living organisms. The knowledge enables us to understand the intricacies of various life processes.

3. EVALUATION

- (i) What kind of 'work' plants do for which they need energy. The teacher may expect the students to list various metabolic activities.
- (ii) Why fertilisers are needed for the growth of plants ?
- (iii) Why lime water turns milky due to exhaled gas ?
- (iv) What is the difference between secretion and excretion ? Give examples (Tears and saliva are examples of secretion and urine and faecal matter are examples of excretion).

4. REFERENCE MATERIALS

1. Science, A textbook for Secondary Schools, Classes IX-X, part I, II—NCERT, New Delhi.
2. Biology—A textbook for Higher Secondary Schools, Class XI, Part I—NCERT, New Delhi.

CHAPTER 30

PRESERVATION OF SELF-II

1. OVERVIEW

One of the essential features of living organisms is the movement. In this chapter children would learn how movements are effected by coordinated working of muscles and bones and are controlled by the brain and spinal cord in case of higher animals. Plants do not exhibit such type of movements but show other kinds of movements. The movements are the responses of organisms to various external and internal stimuli. The chapter covers the different receptors for various kinds of stimuli like touch, smell and sight found in higher animals. The regulation of various metabolic activities in living organisms are controlled by chemical substances secreted by the organisms. The study of these substances helps in knowing various chemical reactions going on in the body.

2. LEARNING OUTCOME

2.1 Key terms

Sedentary animals; Leguminous plants; Locomotion; Movement of curvature ; Flagella ; Cilia ; Setae ; Exoskeleton ; Receptor organs ; Effectors; Voluntary actions Involuntary actions; Adrenalin; Endocrine glands; Hormones; Insulin; Diabetes; Goitre, Nerve cell.

2.2 Major ideas and explanatory notes

- (i) One of the controlled and coordinated activity exhibited by an organism is movement.

- (ii) The movement may be either of the whole body of an organism or only of its part(s)
- (iii) The organs of movement vary from organism to organism, e.g. muscles in higher animals.
- (iv) The movements are the body responses to stimuli.

Notes :

1. Teacher may explain the different kinds of sensation, formation of image on the retina, listening music through ear, smelling through nose, bitter taste felt by tongue, all these are ultimately analysed (perceived) by the brain and not by respective sense organs. The details of differences between voluntary and involuntary actions may also be explained.
2. Teacher may point out that main controlling centres are brain and spinal cord. They coordinate the movements and act as moderators. The process from perception to response may be shown in a flow chart (Receptor → Nerve → Brain → Nerve → movement of the organ).

2.3 Activities

S.No.	Title	Items required	Skills to be developed	Remarks
1	2	3	4	5
1	To observe locomotion and movement in some animals (D).	Microscope, Slide, Fish, Frog, <i>Paramecium</i> , <i>Amoeba</i> , <i>Euglena</i> , Snail, Earthworm.	Observation	
2	To demonstrate movements in plants (D).	Petri dishes, Potted plant, Card box with a hole and	Observation, Slide preparation.	Any plant can be grown in a

1	2	3	4	5
		small window, Seeds, <i>Spirogyra</i> , <i>Chlamydomonas</i> .		broken pitcher.

2.4 Relevance to daily life

The animals we see around us display the ability to move. It makes us realize the importance of movements and their coordination in our body. The movements in a sense are adaptive responses to various foreign agents. It also helps us in understanding the coordinated working of the various parts of the body just like a automatic machine.

3. EVALUATION

- (i) The teacher may ask the students about the flickering of our eyelids.
- (ii) Students may be asked to name a few internal movements, e.g. Brownian movements are the internal movements of cytoplasm which can be seen through microscope. Another example is the production of saliva by sight and smell of food.

4. REFERENCE MATERIALS

1. Animal Physiology—Knut Schmidt Nielsen Foundations of Modern Biology Series, Prentice Hall of India(Pvt) Ltd., New Delhi.
2. Who's Who at the Zoo—Ruskin Bond, National Book Trust India, New Delhi
3. The Cat Family—M. D. Chaturvedi--National Book Trust, New Delhi.
4. Biology, A textbook for Higher Secondary Schools, Class XI, Part I—NCERT, New Delhi,

CHAPTER 31

POPULATION

1. OVERVIEW

Children are aware of the different types of plants and animals around. Each animal and plant has its own habitat. These habitats may be shared by different types of organisms for food and shelter. The number of individuals of each organism in a habitat is controlled by different factors. The chapter deals with the balance of populations of organisms in any area and how it gets disturbed by some external factors the most important being man himself. The study of population will help the children to understand importance of conservation of different living objects. The chapter also covers the interference by cutting trees or indiscriminate use of land and growth of industries in a haphazard manner which will ultimately prove harmful to us.

2. LEARNING OUTCOME

2.1 Key terms

Carnivorous; Ecosystem; Habit; Habitat, Herbivorous; Insecticide; Population; Predominant, Retting.

2.2 Major ideas and explanatory notes

- (i) Number of individuals of each organism in a given area is a population and it can be measured.
- (ii) Each animal and plant has its own habitat.

- (iii) Living and non-living components of an area together constitute the ecosystem
- (iv) Different types of organisms may share a common habitat for food and shelter.
- (v) Availability of food controls the population.
- (vi) The size of population in terms number of individuals varies from season to season.

Notes :

1. While explaining the term ecosystem teacher may point out that in such a system the interactions are between the organisms themselves and with their physical environment. Here example of local ecosystems like pond, lake, river, forests and crop field may also be given.
2. The predominant form or species in an ecosystem may be determined on the basis of its number, size of its population and its contribution towards the dry matter production
3. The retting of jute is a process in which bacteria get multiplied and help in softening the stem. This leads to the separation of fibres from the stem. It is generally done by keeping the jute and sunn plants submerged in a pond.
4. The role of man in influencing the populations of other organisms may be highlighted by examples like the cutting of forests leads to migration and extinction of wildlife species. (Tiger and Cheetah population)

2.3 Activities

S.No.	Title	Items required	Skills to be developed	Remarks
1	2	3	4	5
1.	To draw an outline map of the locality showing various habitats and to study the organisms in each (S).	Pencil, Note book.	Drawing, Observation.	It need not be according to scale. Teacher may keep a rough map ready and demonstrate. (Here it can also be with reference to school, their classroom, temple and park.
2.	To find out the Newspaper and magazines reports regarding effect of human interference on the population(S).	Old newspapers and magazines	Collection, Identification, Classification.	Examples like student population in school, in the class can be used to encourage the study of population.

2.4 Relevance to daily life

The factors like felling of trees, epidemics, natural calamities, development of township lead to the alterations in environment and populations of various organisms. The knowledge of human population helps in determining the food requirement. It enables us to realise the importance of balance between the different populations. Study of populations of organisms helps

us to discriminate between the harmful and useful individuals which may either be removed or maintained.

3. EVALUATION

- (i) The teacher may give data of the student population, of school, of previous years and ask the students to record the changes with time and give factors which have probably affected the school population.
- (ii) Teacher may list some organisms and ask the children to group them into various populations.
- (iii) Teacher may ask the impact of removal of any population completely from the locality e.g. trees, lizards, squirrels and mosquitoes.

4. REFERENCE MATERIALS

- 1. Population—S N. Agarwala, National Book Trust, New Delhi.
- 2. Science, A textbook for Secondary Schools, Class IX, Part I NCERT, New Delhi, Chapter on Man and His Environment.
- 3. Biology, A textbook for Higher Secondary Schools Class XI, NCERT, New Delhi, Unit on Man and Environment,
- 4. Science Today, A monthly scientific magazine—Times of India Building Dr. RN Road Bombay-400001.
- 5. Science Reporter, A monthly scientific magazine—CSIR, New Delhi-110001.

CHAPTER 32

POLLUTION

1. OVERVIEW

In the previous chapter the children have learnt the interdependence of populations. Here they will know more how the living objects around us depend upon the environment. The chapter also includes interrelationship of the living and non-living components of an ecosystem. The balance in the environment may get disturbed by certain environmental factors like pollution. The air, water and soil, if polluted by external agents will ultimately harm the populations of living organisms. The pollution is indirectly brought about by the enormous growth of human population on this planet. In his efforts to exploit nature for benefits, man's survival is threatened.

2. LEARNING OUTCOME

2.1 Key terms

Contamination ; Diffusion ; Explosion ; Epidemic ; Humus ; Nicotin ; Noise ; Pollution ; Pollutant ; Salinity ; Soot ; Water holding capacity.

2.2 Major ideas and explanatory notes

- (i) The organisms and their physical environment are inseparable. Air, soil, water, plants and animals constitute the environment of an organism.
- (ii) Any invasion of foreign substances leads to imbalance in the environment.
- (iii) Air, water and soil get polluted.

- (A) The polluting agents are noise from automobiles, aeroplanes, railway engine. Smoke, fog, and industrial outlet garbage also pollute the environment.
- (v) Pollution of the environment causes several diseases as well.

Notes :

- 1 Sudden appearance of a disease and its spreading in a very short time over a large area by same organism is called epidemic. When germs of the disease are carried by water the disease is called water-borne e. g. typhoid, cholera. When germs are carried by air, then the disease is categorised as air-borne e.g. influenza (common cold).
- 2 Noise may be explained as unpleasant and unwanted sound.
- 3 Enormous growth of human population is referred to as explosion of human population.
- 4 The teacher may explain that soil also gets polluted due to excessive use of fertilisers, pesticides and other chemicals.
- 5 Ultimately the pollutant reaches our body from the soil through crop, buffalo and milk.

2.3 Activities

S.No.	Title	Items required	Skills to be developed	Remarks
1	2	3	4	5
1.	To observe the effect of washing soda on fish (S).	Beaker, Washing soda, Live fish.	Observation	
2.	To demonstrate the substances	Candle, Wood, Cloth piece, Ke-	Experimental, Observation.	

1	2	3	4	5
	present in the smoke (D).	rosene lamp, Jar, Test tubes, Delivery tube, Paper, Coil, Live insect, Sulphur.		
3.	To list the common pollutants and their sources (S).	Pencil, Paper.	Identification	Teacher may give the names of uncommon pollutants.
4.	To list various environmental changes during various seasons and advantages and disadvantages of each (D & S).	Pencil, Paper.	Identification	
5.	To discuss with teacher/parents / elders in the community about the changes which have taken place in locality since your birth (D & S).	Pencil, paper.	Identification of problems	Teacher may give problems of environment in our country
6.	To identify the sources of noise in the locality (S).	Pencil, paper.	Identification	

1	2	3	4	5
7.	To Filter water for drinking using pebbles, sand, filter paper, charcoal (S).	Pebbles, Sand, Filter paper, Charcoal, Vessels.	Setting up	

2.4 Relevance to daily life

In the previous chapter on population we found that it is affected by certain factors of which pollution is one. There are various means of pollution. While planning for an industry, a city or any other complex, we must bear pollution in mind and try to minimise it to the maximum extent possible. Smoking—a form of air pollution can be lessened by personal efforts. Water tanks and other storage places be cleaned periodically to provide clean drinking water. Houses should be properly planned to ensure good ventilation.

3. EVALUATION

- (i) The teacher may ask the reasons of no life on other planets like Mars and Moon.
- (ii) Why trees/plants are grown in our homes as well as in the locality ?
- (iii) What will happen to historical monuments if industries are set up nearby ? The example of Taj Mahal and refinery at Mathura can be given by the teacher.

4. REFERENCE MATERIALS

1. Biology, A Textbook for Higher Secondary Schools, Class XI, Part I, NCERT, New Delhi. Unit on Man and Environment.

2. Man in Nature—Marston Bates—Foundations of Modern Biology Series, Prentice Hall of India (Pvt.) Ltd. New Delhi.

3. Scientific Magazines given below may also referred by the teacher for popular and technical information.

(i) Science Today

(ii) Everyday Science

(iii) Science Reporter

(iv) School Science

CHAPTER 33

LIGHT-I

1. OVERVIEW

Children come across a number of interesting optical observations connected with shadow, source of light besides reflection and refraction of light, and are curious to know about them. In this chapter there is a scope for them to learn basic ideas about shadow formation, light travel, luminous bodies, reflection from regular and irregular surfaces and light bending.

Children in the earlier classes have only been introduced to shadows and the phenomenon of reflection. There was no scope then to bring in the ideas about sources of light and to give explanation for some connected common observations.

2. LEARNING OUTCOME

2.1 Key terms

Visibility ; Sources of light, Cold & hot ; Fire fly ; Hurricane lamp ; Luminous; Nonluminous; Opaque; Translucent & transparent; Shadow —sharpness and shape ; Eclipses ; Regular & irregular reflection; Reflectors ; Semi-dark ; Umbra ; Penumbra ; Refraction of light ; Medium ; Denser medium ; Glass slab ; Emergent ray ; Prism, Deviation ; Angle of deviation ; Rectilinear propagation of light.

2.2 Major ideas and explanatory notes

- (i) Luminous bodies emit light of their own.

- (ii) Colour of the light emitted by a body depends upon the temperature of the body.
- (iii) Non-luminous bodies do not emit light of their own. They become visible by reflecting light from luminous bodies.
- (iv) Luminous or non-luminous bodies become visible only when the light given out or reflected by them is received by a normal eye.
- (v) Irregular reflection of light by a surface is called scattering.

Note ;

Scattering of the light by a surface depends upon the shape, smoothness and colour of the surface.

- (vi) Light travels in a straight line.
- (vii) Shadow of an object is caused when it interrupts the light from a source.

Note :

Sometimes shadow of an object cannot be observed (e.g. a flying bird).

The size and shape of the shadow depends upon the size of light, the distance between the object and the source of light, the distance between the object and the screen used to observe shadow and object's shape and orientation with respect to the source.

- (viii) The shadow has completely dark as well as the relatively less dark portions.
- (ix) The sizes of umbra and penumbra depend upon the distance between the source, object and the screen, and size of the source.
- (x) When a ray of light travels from one medium to another it bends.

Note :

The ray of light bends towards the normal at the interface when coming from a medium to denser one. Again when it goes from the denser medium to a less denser one, it bends away from the normal at the interface.

- (xi) In the case of a glass slab, the relative displacement of the emergent ray increases with the increase in the angle of incidence for the same thickness of the medium.
- (xii) For a fixed angle of incidence, the relative displacement of the ray increases with increasing width of the slab.

2.3 Activities

S.No.	Title	Items required	Skills to be developed	Remarks
1	2	3	4	5
1.	To observe the colour of the light emitted by an object changes upon heating (S).	Electric heater	Understanding of colour change with temperature, Observation.	The teacher may demonstrate with the help of an electric heater, The colour of the heating element changes from dull red to bright red to yellowish as its temperature increases. Alternatively,

1	2	3	4	5
				the students may be asked to observe the change of colour of an iron piece when it is heated by an iron-smith (<i>Lohar</i>).
2.	To study the formation of umbra and penumbra in shadows (S).	A torch or electric source of light, a ball suspended on a string.	Observation	Size of the shadow and size of umbra & penumbra, depends on the distances between (i) source and objects (ii) objects and screen (iii) size of source and object.
3.	To observe the passage of light through a glass slab with the help of a ray box. (S).	Source of light, Glass slab, Ray box.	Observation	(i) The light path changes direction at the surface of separation between air and glass slab (ii) The displacement of light increases

2.4 Relevance to daily life

Light is an important means of learning about the world around us and hence its study is necessary. The study of formation of shadows helps us in knowing the lunar and solar eclipses. Understanding some of the common observations about the sources of light (cold and hot) and those connected with refraction is helpful in several ways.

3. EVALUATION

- (i) Students should be asked to list the common sources of light they come across and indicate against each if it is cold or hot.
- (ii) Students can be asked to observe some common situations of shadows and to draw diagrams. They can be asked to analyse the variation in their sizes by changing size of the source, size of the object, and distance between the source, the object, the screen.
- (iii) Students may be asked to observe some simple phenomena caused by refraction of light and asked to explain them. For example a pencil appears to be broken when dipped in a tumbler having water or a coin appears to be raised from the bottom when dropped in a tumbler of water.

4. REFERENCE MATERIALS

1. Science, A textbook for Secondary Schools, Class X, Part II—NCERT, New Delhi.

CHAPTER 34

LIGHT AND COLOUR

1. OVERVIEW

The children have learnt about the common properties of light like reflection and refraction. Another interesting and commonly observed aspect of light is colour. The colours have been discussed in the present chapter. The sun-light consists of seven rainbow colours from violet at one end to red at the other. Basic ideas about mixing of colours are discussed. The fact that a prism can split white light into rainbow colours is also covered. Two more light phenomena that of 'parallax' and 'persistence of vision' too are introduced.

2. LEARNING OUTCOME

2.1 Key terms

Rainbow; Cellophane; Primary colour; Secondary colour; Band; Spectrum; Infra-red; Ultra-violet; Parallax; Opaque; VIBGYOR

2.2 Major ideas and explanatory notes

- (i) The colour of an object depends on the colour of the light that reaches our eye from it.
- (ii) An object of any colour absorbs light of all colours except its own colour.

Note :

It only reflects the light of its own colour. White objects reflect all the colours whereas black objects absorb all the colours.

- (iii) There are three primary colours from which all other colours can be made.

Note :

Red, green and blue are the primary colours. The other colours may be obtained by suitably combining these coloured lights. The red, yellow and blue pigment colours cannot be had by mixing any other pigment colours.

- (iv) To obtain different colours, definite proportion of primary colours is required.
- (v) The white sun light can be split into its seven constituent rainbow colours.

Note :

The teacher may point out that proper mixing of the rainbow colours results in white.

- (vi) Colours occur in a definite sequence.

Note :

Infra-red light precedes the red light in the visible spectrum and ultra-violet light is next to the violet light in the visible spectrum of light.

- (vii) The impact of an event persists on the retina of human eye for a very short duration. This results in giving continuity to the running film of an event when we see a movie.
- (viii) There is a relative movement between the two objects, some distance apart, when viewed by a moving eye.

2.3 Activities

S. No.	Title	Items required	Skills to be developed	Remarks
1	2	3	4	5
1.	To demonstrate seven colours of white sun light (D).	Phirki or card board disc painted with seven rainbow colours.	Observation, Inference	White light can be produced by mixing by rotation the lights of rainbow colours.

1	2	3	4	5
2	To study the visibility of the colour of object(S).	A black and white picture, Red, blue and green cellophane pieces.	Observation, Inference.	A white object reflects all the colours of sun light. Colour of an object depends upon the colour of the light reflected by the body.
3.	To study the sun-light colours of the rainbow using a prism or mirror strip and water(S).	Prism or a mirror strip, Water, Container.	Observation, Inference.	When-sun light is passed through a prism, rainbow colours are obtained.
4.	To observe the pictures of parrot and cage drawn on the different sides of the card-board while rotating at different speeds(S).	Card-board with parrot drawn on one side and a cage on the other side, fixed to a pencil for rotation by hands.	Observation, Inference.	Impact of an event remains on human eye for a very short interval of time. If two events take place within that short interval of time they cannot be seen as distinct events. The activity to observe the blades of a fan or spokes of the wheel of a bicycle when rotating at a fast and slow speed can also be done by students.

1	2	3	4	5
5.	To demonstrate the phenomenon in the open of 'parallax' (D). (distant objects like electric poles or trees in a line).	A suitable view	Observation. Inference.	i. Nearby object appears to be moving faster. ii. When the objects are at same distance, no apparent motion between them results. Students may be asked to observe two distant objects like two electric poles or two trees in a line and look for the apparent motion of one with respect to other when eye is moved from one side to the other.

2.4 Relevance to daily life

This chapter is important for the study of the colours and their sensation as perceived by our eyes. It also helps us in knowing how natural phenomena like that of rainbow occurs. The study of 'parallax' provides a method for measurement of distances of far off objects like stars. The idea about the persistence of vision explains how the running film provides continuity of moving scene in a cinema.

3. EVALUATION

- (i) The students may be asked to observe the colours of various common objects through a cellophane piece of red colour and explain their observation.
- (ii) The students may be asked to prepare a rotatable disc and to paint it carefully with the seven rainbow colours. They should observe it when rotating and report their observation to the class and also explain the same.

- (iii) The students may be asked to split the sunlight using a mirror strip and some water in a shallow vessel like a dish plate and to explain the activity.
- (iv) The students may be asked to relate any common example, one each of the phenomena of
 - (i) parallax, and
 - (ii) persistence of vision.

4. REFERENCE MATERIALS

1. Physics, A textbook for Higher Secondary Schools, Class XI, Part I--NCERT, New Delhi, Chapter on 'Optics'.

CHAPTER 35

MORE ABOUT ELECTRICITY

1. OVERVIEW

The children have by now learnt about the use of electrical energy in many situations. They also know the various effects of electricity and their applications in day-to-day life. The present chapter aims at providing them some more information about electricity which can help them in proper selection of bulbs and electrical fittings and also to take proper care in handling electrical appliances.

In this chapter an elementary concept of resistance and potential difference has been given. The flow of current has been compared with the flow of water between two connected vessels. The pressure difference between the levels of water provides an analogy to the electric potential difference between the two terminals of the source of electricity. A very elementary idea of a galvanometer, ammeter and voltmeter has also been given.

The units of resistance and potential difference have been mentioned.

2. LEARNING OUTCOME

2.1 Key terms

Electric circuit; Potential difference, voltage, Volt, Current; Galvanometer; Voltmeter; Ammeter; Resistance; Ohm; Series & parallel connection; Electrons

2.2 Major ideas and explanatory notes

- (i) The potential difference is difference in temperature in case of heat, difference of height (level) in case of water and in case of

electric current it is the difference in electric potential. It is measured in volts.

- (ii) The strength of the electric current is represented by units.
- (iii) Electric resistance also has a unit

Note :

One ohm resistance is offered by a conductor through which one ampers of current flows and the potential difference across it is one volt
The resistance is given by the relation

$$\text{Resistance (R)} = \frac{\text{Voltage (V)}}{\text{Current (I)}}$$

2.3 Activities

S. No.	Title	Items required	Skills to be developed	Remarks
1	2	3	4	5
1.	To study the flow of water from one vessel to another (S).	Two suitable vessels, Rubber tubing, Pinch cork and water.	Making circuit, Observation Inference	
2.	To observe the difference between potential through performance lighting of a torch bulb(S).	Dry cells(4), Torch bulbs, Connecting wires, Key.	Making circuit, Observation, Inference	
3.	To study the dependence of the current on metal,length and area of cross section of the wire(S).	D.C.C. or enamelled copper wires and constant on wires of different diameters, Torch bulb, Ammeter, Key, 3 dry cells, Connecting wires,	Making circuit, Observation Inference.	Wire is used as a resistance

1	2	3	4	5
4.	To improvise a device for detecting electric current(S).	Empty match box, D C C., copper wire, Magnetic compass, and a dry cell	Improvisation, Observation.	

2.4 Relevance to daily life

Such a knowledge about electricity helps us in various ways. Firstly, it helps in choosing proper bulbs, electrical fittings and to read the simple circuit diagrams. Secondly it helps in the tasks like fixing the fuse or for decoration by using the electric bulbs. The third utility of this knowledge is awareness of the danger involved in using the electric mains and of handling electrical fittings. One can take care while using them.

3. EVALUATION

- The students may be asked to improvise a simple device (using a compass) for detecting electric current. They may be asked to show its use with the help of a dry cell as a simple source of electric current.
- The students may be asked to speak what they know about the terms like voltage, current, resistance and to tell the units in which each one is measured.
- The students may be asked to use a dry cell and other components to make a simple electrical circuit for which the circuit diagram is given to them

4. REFERENCE MATERIALS

- Physics, A textbook for Secondary Schools, Classes IX-X, NCERT, New Delhi, Chapter on Electricity.
- Inventions that Changed the World,—Part II—Mir Najabat Ali, National Book Trust, New Delhi.

CHAPTER 36

ELECTRICAL ENERGY

1. OVERVIEW

In this age of electricity, we have to depend on the electrical gadgets. Some toys also run on electric motor. When current is switched on, the flow of energy makes them work. In this chapter the children will come to know the precautions they should observe while using electricity from the mains.

It is of great interest to the children to know the generation of electrical energy in the power stations and its transmission to the distant villages and cities. In this topic they will learn about these and the units for measuring electrical energy and may even compute the total cost for running common gadgets.

The pupils have already learnt the use of electrical and magnetic energy in primary classes. They have further been acquainted with the effects of electric current in class VI and also in the previous chapter.

2. LEARNING OUTCOME

2.1 Key terms

Electrical appliances; Cable; Electric poles; Plug; D. C. (Direct Current); Watts; Megawatts; Generator; Electric meter; Fuse; Insulated wire; Voltage fluctuation; Load shedding; A.C. (Alternating current); Kilo watt; Kilowatt hours; Transformers, step up, step down; Transmission; Short circuit.

2.2 Major ideas and explanatory notes

- (i) A dry cell gives direct current at 1.5 volts.

- (ii) Electric current supplied by mains is generated at the power stations.
- (iii) A. C. (alternating current) is generated generally by using energy of fast moving water.
- (iv) Electric mains is a vast source of energy and is dangerous if not used properly.
- (v) Fuse is a safety device and can break an electric circuit
- (vi) Different appliances have different power ratings. In other words they use different amounts of power.
- (vii) A. C. is stepped up with transformers before transmitting it and it is stepped down when supplied for use.
- (viii) A dynamo converts mechanical energy into electrical energy.

2.3 Activities

S. No.	Title	Items required	Skills to be developed	Remarks
1	2	3	4	5
1.	To study the different resistance wires and amount of energy used (D & S).	50 cm long resistance wires of nichrome, Eureka (of 24 & 30 SWG), Copper wire enamelled, Dry cell, Connecting wires and sand paper.	Observation, Inference, Experimentation.	
2.	To observe the working of a fuse(S).	Dry cell, Thin tin foil (as found in some cigarette cases) and connecting wires.	Observation, Inference, Experimentation.	
3.	To observe the effect of rotation of the	A bicycle with dynamo fitted on hind wheel,	Observation, Inference,	Low speed gives dim

1	2	3	4	5
	magnets in a coil of copper wire (as in a dynamo) on production of electric energy(D & S).	Head lamp (on loan) or a working model of cycle dynamo.	Experimenta- tion	Light and high speed gives bright light).
4.	To enlist the power rating of some heating appliances available in the school and to calculate electricity consumed in one hour (D & S).	Any two of the electric bulbs fitted in a table lamp. Electric fan, Electric heater, Electric press and a soldering iron.	Observation, Computation and inference.	

2.4 Relevance to daily life

This unit is very closely connected with daily life situations (use of electric appliances). The working of a simple dynamo is similar to that of generators at the power station. In the case of a bicycle the rotation of the hind wheel of the bicycle provides movement to the magnet in a coil, whereas the rushing water or steam does the same job in big generators. The students will realize the importance of using a fuse and its blowing away and how it provides safety in the circuit. The students will also appreciate the use of a proper fuse wire.

3. EVALUATION

The students should be asked to write :

- (i) The units for measuring potential difference, current and electric energy.
- (ii) Briefly all the steps from generation of electricity at a power station to using of this power in an electric lamp.
- (iii) The risk that is run when a fuse is not used in an electric circuit.

4. REFERENCE MATERIALS

1. Physics, A textbook for Secondary Schools, Classes IX-X—NCERT, New Delhi, Chapters on 'Electricity' and 'Magnetism'.
2. Physics, A textbook for Higher Secondary Schools, Classes XI-XII—NCERT, New Delhi, Relevant readings from the chapter on 'Electricity and Electromagnetic Induction'.
3. Inventions that Changed the World, Part II—Mir Najabat Ali, National Book Trust, New Delhi.

CHAPTER 37

ELECTRICAL MAGNETISM

1. OVERVIEW

The children have known by now that electric current in a wire affects a magnetic compass. They have also known about the magnetic field of the earth. The present chapter aims at acquainting them with some useful common electrical devices using electromagnets. Electromagnets are of different types and are used in devices like electric bells and telephones.

Some children may be aware of small electric motors used in some toys like electric trains. They will learn the use of motors in table fans and ceiling fans. The various aspects of electric motors like working on different voltages are also introduced here

2. LEARNING OUTCOME

2.1 Key terms

Electromagnet; Battery eliminator; Magnetic field; Transformer; step-up and step down; Crocodile clip (a clip for securing tight connections); Detector (a magnetic compass used for detecting electric current) Magnetism; Induced current; Electric motor; Loop; Electric bell; Universal motors (working on both A.C. and D.C.)

2.2 Major ideas and explanatory notes

- (i) Electric current passed through an insulated copper wire wound round a piece of iron makes it a magnet.

Note :

This type of a magnet is called an *Electromagnet*. An electromagnet works as long as the current passes through the wire wound around it.

- (ii) A magnet or an electromagnet exerts its influence in a space around it.
- (iii) A transformer steps up or steps down the voltage.

Note :

It works on the principle—electromagnetic induction, and is used with AC mains.

- (iv) A coil of wire capable of rotation and carrying current rotates when placed in a magnetic field. This is the basic principle of an electric motor.

Notes :

- (1) An open view of the electric bell should be shown to the students. Magnetisation and demagnetisation of the electromagnet should be explained

- (2) If possible, the teacher may arrange a class trip to a post-office having telegraph and telephone facilities to enable the students to have a first-hand knowledge about these devices.

A step-down transformer can be illustrated by showing a (open view) inside of a night lamp (even a damaged unit will do). However, if possible a torch lamp should be lighted with simple battery eliminator using the A.C. mains.

2.3 Activities

S. No.	Title	Items required	Skills to be developed	Remarks
1	2	3	4	5
1.	To make a simple electromagnet and to see that magnetism lasts only till the current flows (D&S).	A large iron nail, Enamelled copper wire, 2 clips, dry cells, a key and some small iron nails,	Experimentation, Improvisation.	

1	2	3	4	5
2.	To have an inside view of an electric bell (S).	An Electric bell working with low voltage (2.5 to 6 v), Key, Screw driver and dry cells or battery	Observation	
3.	To have an idea of electromagnetic induction (D&S).	Clips, Enamelled copper wire, Soft Iron ring, Cells/battery, Key and compass.	Experimentation, Improvisation.	To setup a model transformer and observe the flow of current in the secondary. If a low voltage A.C. source is not available changing-current will do by using dry cells and continuously tapping of one connection.

2.4 Relevance to daily life

There are many electrical appliances, using electromagnets, which the students come across in life. The knowledge of an electromagnet, transformer and a simple meter will help them to appreciate their working. The students like to know about working of the devices such as electric bell, telegraph equipment, telephone and night-lamps.

3. EVALUATION

- (i) The students should be asked to make an electromagnet using soft iron nails and test its polarity with the help of a magnetic compass.

- (11) Students may be asked to list up the common electrical devices using (i) an electromagnet and (ii) a transformer.

4. REFERENCE MATERIALS

1. Physics, A textbook for Secondary Schools, Classes IX-X—NCERT, New Delhi, Chapter on 'Magnetism'.
2. Physics, A textbook for Higher Secondary Schools, Classes XI-XII, Part II—NCERT, New Delhi. Chapter on 'Electromagnetic Induction'.
3. Inventions that Changed the World, Part II—Mir Najabat Ali, National Book Trust, New Delhi.

CHAPTER 38

STRUCTURE OF ATOM

1. OVERVIEW

The children are familiar with different substances which differ in properties from each other. The chapter deals with the nature and composition of substances, the nature of an atom : electrons, protons and neutrons and their location in an atom, the model of an atom and isotopes. The idea of various particles which an atom is composed of will be made use of in the following chapter on Nuclear energy.

2. LEARNING OUTCOME

2.1 Key terms

Atomic number, Electrons, Cathode rays, Molecules; Neutrons; Protons; Unit positive charge; Unit negative charge; Nucleus; Energy levels, Shells; Isotopes.

2.2 Major ideas and explanatory notes

- (i) The nature and composition of substances differ from one substance to the other.
- (ii) Each substance has atoms or molecules.
- (iii) Atoms consist of electrons, protons and neutrons.
- (iv) In an atom electrons are orbiting around its nucleus.
- (v) The protons and neutrons in an atom are located in its nucleus.
- (vi) In some chemical elements the number of protons in the nuclei of their atoms is the same but the number of neutrons is different,

2.3 Activities

S. No.	Title	Items required	Skills to be developed	Remarks
1	2	3	4	5
1	To prepare simple models of atoms of Helium, Oxygen and Sulphur(S).	Cardboard, White drawing sheets, Gum. Plasticine, Thread.	Experimental	
2.	To draw a chart of a model of an atom (S).	Chart paper, Coloured pencils.	Experimental	

2.4 Relevance to daily life

The model of an atom is comparable to our solar system. The number of protons present in the nucleus of an atom represents the atomic number of that atom. Isotopes are used for a variety of purposes including medicine, agriculture, food preservation, production of atomic energy, etc.

3. EVALUATION

The students may be asked

- (i) If it is possible to split or break the smallest particle of matter?
- (ii) if there is anything common in all materials?
- (iii) to explain the terms, electron, proton, neutron, atomic number.
- (iv) to compare the structure of an atom to the solar system?
- (v) to name the various isotopes of carbon and oxygen.

4. REFERENCE MATERIALS

1. Science, A textbook for Secondary Schools, Classes IX-X, Parts I-II—NCERT, New Delhi.

CHAPTER 39

NUCLEAR ENERGY

1. OVERVIEW

The children are already familiar with the structure of atom—it being composed of electrons, protons and neutrons. They also know that the number of electrons and protons in a neutral atom is the same. The children have also studied about chemical reactions.

In this chapter, they will read about different nuclear reactions like splitting of bigger atoms into smaller ones (fission) and fusing smaller atoms into bigger atoms (fusion). The chapter also deals with peaceful uses of nuclear energy and its misuse as a destructor (atom bomb). The phenomenon of radioactivity and its uses in medicine and agriculture and for finding out the ages of mountains or bones of long dead animals is also discussed. Apart from its uses, chapter covers the hazards of radioactive substances like exposure over long periods of time can be extremely dangerous to our health because it can destroy our body cells and also cause long term genetical defects.

2. LEARNING OUTCOME

2.1 Key terms

Nuclear explosion; Radioactive dating; Radioactive tracers; Nuclear device; Atom bomb; Nuclear power, Nuclear medicine laboratory; Atomic and Nuclear energy; Isotopes; Nuclear reactors (Atomic reactors), Nuclear reaction; Alpha particles; Beta particles; Gamma-rays; Fission; Fusion, Chain reaction (controlled and uncontrolled) Nuclear fuel; Fall out of radiation; Implosion (underground nuclear

explosion); Nuclear test; Spontaneous emission; Radioactive decay; Disintegration (of nucleus); Half-life.

2.2 Major ideas and explanatory notes

- (i) In a nuclear reaction, the number of protons and/or number of neutrons changes.
- (ii) The energy changes in nuclear reactions are much larger as compared to those in chemical reactions.
- (iii) In nuclear changes, new atoms are produced either by splitting or fusing together of the nuclei of some atoms.
- (iv) Splitting of a nucleus can be effected by bombarding it with energetic fast moving particles.

Notes :

1. Fission is a process in which a heavy nucleus breaks up into two equal nuclei in the intermediate range. For certain reactions, we also require less energetic and slow moving particles.
 2. Nuclear fusion is a process in which two or more light nuclei combine to form a new heavier nucleus. A lot of energy is also released in this process.
- (v) A nuclear reaction is initiated by neutrons.

Note :

Sometimes neutrons are also produced in the final stage. A chain reaction occurs if the neutrons so produced can initiate further reaction.

- (vi) The nuclear reactions in an atomic reactor can be controlled and the energy released can be used for peaceful purposes.

Note :

The word atomic energy is a misnomer. The correct word is nuclear energy.

- (vii) A nuclear reaction, if allowed to proceed in an uncontrolled manner, can cause severe explosion due to release of an enormous amount of energy. These explosions can be exploited for both harmful and useful purposes.

Note :

Nuclear changes occurring spontaneously are known as radioactive decay. During this process, either alpha-particles or beta-particles or gamma rays, or any two of them or more are emitted. The time in which half the number of atoms of a radioactive substance decay is called its half-life.

By measuring radioactivity in a specimen of a long lasting object, we can estimate the life of the object. This technique of estimating the life of old rocks, extinct animals and plants is known as radioactive dating.

2.3 Activities

S.No.	Title	Items required	Skills to be developed	Remarks
1	2	3	4	5
1.	To prepare a chart showing chain reaction(S).	Chart paper, Coloured pencils.	Experimental	
2.	To prepare a chart showing some common uses of radioactive isotopes using illustrations, news paper and magazine cuttings(S).	Chart papers, Coloured pencils, News paper cuttings, Magazine cuttings.	Experimental	

2.4 Relevance to daily life

Radioactive substances in small quantities are now-a-days used in hospitals for curing some diseases like cancer and thyroid, etc.

Radioactive substances are also being extensively used in agriculture and medicine. They are used for radio carbon dating and for determining the age of old rocks and fossils, for preserving the food stuff and for determining mechanical wear and tear in machines.

3. EVALUATION

Students may be asked to find out :

- (i) the names of some radioactive substances and their half lives.
- (ii) whether a particular substance decays by emitting alpha-particles, beta-particles or gamma rays.

4. REFERENCE MATERIALS

1. Science, A textbook for Secondary Schools, Classes IX-X, Parts I-II - NCERT, New Delhi
2. Nuffield Combined Science: Teachers Guide, Parts I, II, III—Nuffield foundation.

CHAPTER 40

CARBON IN NATURE

1. OVERVIEW

The children use and see different kinds of materials, such as food materials, natural cloth (cotton, silk), synthetic cloth (terylene, nylon). They also see coal, wood and plants. The above materials after burning give black residue. This black residue is carbon. The chapter includes different forms of carbon (crystalline, amorphous) and their uses. The properties of some substances after burning are also mentioned. The children will also learn about the different zones of the flame.

2. LEARNING OUTCOME

2.1 Key terms

Graphite; Diamond; Amorphous; Allotropy; Combustion; Non-combustible; Ignition temperature; Flame, Zone of combustion.

2.2 Major ideas and explanatory notes

- (i) Carbon is found in all living and some non-living materials e.g. lime stone and terylene etc.
- (ii) Carbon is found in different forms.
- (iii) Different forms of carbon have different uses.

Notes :

- 1. Crystalline form or the non-porous form (diamond & graphite)
- 2. The amorphous form is a mixture. It is used as a fuel e.g. charcoal. The chemical properties of above forms are same, they differ only in physical properties.

- (iv) Oxidation process involves the evolution of heat and light.
- (v) Various conditions are necessary for combustion.

Notes :

1. Presence of combustible substance e.g. paper, kerosine oil, wood etc.
 2. The presence of a supporter of combustion (air containing oxygen)
 3. The attainment of ignition temperature.
- (vi) The combustion is of various types.

Notes :

1. Rapid combustion e.g. cooking gas.
 2. Spontaneous combustion e.g. phosphorus.
 3. Explosion e.g. cracker.
- (vii) There is a zone of combustion of gaseous substances.

Notes :

1. The inner most part near the wick.
 2. The luminous zone (middle zone).
 3. The non-luminous zone or the outer most zone (hottest part).
- (viii) Flame has structure and each zone has certain properties.

2.3 Activities

S. No.	Title	Items required	Skills to be developed	Remarks
1	2	3	4	5
1.	To produce carbon and carbon dioxide by heating(S).	Sugar, Atta, Wood pieces, Cloth pieces, Paper	Experimental	

1	2	3	4	5
2.	To observe different forms of carbon(S).	Pencil, Dry cell, Coal, Lamp black Charcoal.	Experimental	
3.	To demonstrate combustion and conditions necessary for burning(D).	Kerosene oil, Wax, Spirit, Wood shavings, Test, tubes, Spirit lamp	Observation	
4.	To observe different types of combustion(D).	Phosphorous, Spirit, Crackers.	Observation	
5.	To observe different parts of a flame and their heating effects(D).	Candle, Match box, Slide, Wire, Glass tube.	Observation, Experimental.	

2.4 Relevance to daily life

The green plants fix carbon in the form of starch by taking up the carbon dioxide of the atmosphere. This is a common process of preparing food by green plants. We find coal is also the result of conservation of plant and animals bodies of the prehistoric times into carbon but today such physical conditions (temperature, pressure) are not present and there is no new formation of coal.

The knowledge thus gained helps in making judicious use of coal which is a exhaustible resource. Combustion is a very common experience. A substance will burn if the following conditions are satisfied.

The substance must be a combustible one.

There should be a supporter of combustion.

The attainment of ignition temperature.

The use of fire extinguishers for controlling the combustion is also a common experience.

3. EVALUATION

- (i) What is produced when food materials, fuels and cotton are burnt?
- (ii) What is produced when coal, wood, and oils are burnt?
- (iii) Why is hard coke preferred for hotels and soft coke in our homes?
- (iv) Why do flames of spirit lamp and kerosene oil lamp have a colour?

4. REFERENCE MATERIALS

- 1. Science, A textbook for Secondary Schools, Classes IX—X, Parts I-II - NCERT, New Delhi.

CHAPTER 41

COMPOUNDS OF CARBON

1. OVERVIEW

The children already have learnt about existence of carbon in nature, its different forms and uses, flame and its different zones. In this chapter they will know more about the various compounds of carbon, their preparation, properties and various uses.

2. LEARNING OUTCOME

2.1 Key terms

Lubrication; Effervescence; Fractional distillation; Distillate; Petrochemicals, Coagulation, Sedimentary layers; Hydrocarbons.

2.2 Major ideas and explanatory notes

- (i) Carbon dioxide can be obtained from various materials by different methods.
- (ii) Carbon dioxide exhibits physical and chemical properties.
- (iii) Carbon dioxide has a wide use.
- (iv) Carbon on burning also gives carbon monoxide.
- (v) Carbon dioxide does not occur free in nature.
- (vi) Carbon and hydrogen has different compounds.
- (vii) Petroleum on fractional distillation yields many products.
- (viii) Carbohydrates, proteins and fats are organic substances containing carbon, hydrogen etc.

2.3 Activities

S.No.	Title	Items required	Skills to be developed	Remarks
1	2	3	4	5
1.	To test for carbonates and bicarbonates(S)	Sodium carbonate, Calcium bicarbonate, Hydrochloric acid, Litmus paper, Spirit lamp, Lime water, Test tubes.	Experimental, Observation.	
2.	To study the presence of carbohydrates fats and proteins in food (D).	Potato, Ghee, Oil, Egg	Observation	

2.4 Relevance to daily life

Large number of our food items involve the use of carbondioxide e.g. washing soda, baking soda, various kinds of aerated drinks, bread, cakes, etc. solid carbon dioxide (dry-ice) is used for refrigeration. Carbon dioxide is also used in fire extinguishers. Washing soda (sodium carbonate) is a white powder soluble in water. It is commonly used at home for washing purposes. It is used for the production of glass, soap, and in food and textile industry. The knowledge about the poisonous carbon monoxide from burning of wood in a limited supply of air (closed room or a poorly ventilated room) helps us in better living. Petroleum is a very important raw material for industry. Several products obtained from petroleum distillation are used for manufacturing of dyes, medicines, explosives, alcohol, plastic etc. It is also called *black gold*. The domestic cooking gas is also a product of petroleum. The chapter provides information on constituents of our food items.

3. EVALUATION

- (i) Students may be asked to write the chemical equations for the following reactions.

- a. Reaction of Hydrochloric acid on calcium carbonate.
- b. Reaction between carbon dioxide and calcium hydroxide.

Teacher may also ask the following questions.

- (ii) Why is it harmful to sleep in a close room with a burning *angithi* ?
- (iii) Where is petroleum found ?
- (iv) How are the various constituents of petroleum separated ?
- (v) How can you test for the presence of starch in various food stuffs ?

4. REFERENCE MATERIALS

- 1. Science, A textbook for Secondary Schools, Classes, IX-X, Parts I-II--NCERT, New Delhi.

CHAPTER 42

OUR LIVING WORLD

1. OVERVIEW

The children are aware of variety of organisms. They have also read that all the living objects around can be classified into different groups according to their similarities. To identify a living object each organism has a scientific name which consists of the name of genus and species to which it belongs. In this chapter they will learn more about the micro-organisms present around. For example virus, bacteria, fungi, algae, protozoa and a few other small organisms.

The children will also become aware of harmful and beneficial micro-organisms. They decompose waste products and help us in many ways while some cause serious diseases. The control of various diseases caused by the disease causing organisms has also been discussed.

2. LEARNING OUTCOME

2.1 Key terms

Antibiotics; Anthrax, Anaesthesia, Chloroform; Class, Foot and mouth disease in cattle; Causative organisms; Penicillin, Streptomycin; Chloromycin; Vaccine; Infectious disease; Scabies; Toxic substance; Family; Order, Phylum; Division; Microbes; Unicellular; Multicellular; Free-living; *Plasmodium*; Symbiosis; Virus; Decomposition Decay; Sewage; Sedimentation; Sludge; Fermentation; Vector; Inhale; Edible; Spontaneous generation; Immunity; Inflammation; Pus; Gangrene, Sterilization; Anaesthetic; Disinfect; Pasteurization; Flash method; Sepsis; Resistant.

2.2 Major ideas and explanatory notes

- (i) Each organism has a scientific name. The scientific name of an organism consists of generic and specific name of that organism.
- (ii) The living world is classified according to their similarities in structure.

Note :

The categories of classification are phylum, class, order, family, genus and species. The classification indicates the relationship of the different organisms.

- (iii) There is a group of small organisms which one cannot see with the naked eye e.g. virus and bacteria.

Notes :

We cannot see micro-organisms through the naked eye. These are seen only through microscope. Electron microscope can highly magnify an object. Today, electron microscope is used to study the details of very minute organisms.

Bacteria are single celled organisms. The nuclear material remain diffused in the cytoplasm so that no definite organised nucleus with nuclear membrane is seen.

The shape of the bacteria may be comma shaped, rod shaped, spherical, spiral etc. Some bacteria have cilia on their surface. The teacher may explain the figure 12.4 of textbook with the help of the hints given above.

- (iv) The microbes are either useful or harmful to us.
- (v) Some of the micro-organisms are multicellular.

Note :

The teacher may give examples of *Mucor*, *Penicillium* and *Streptomyces*. The teacher may also explain how the plant *Chlorella*, a kind

of green algae may be a source of our food in future. It contains certain protein.

(vi) Micro-organisms spread diseases through different means

Note :

The teacher may point out that vectors are the carriers of the germs and the disease producing germs undergo certain development in their the carrier before becoming infective. Mosquito is the vector of malarial parasite. The carrier may simply transfer the germ from the excreta to the food of the healthy organisms, house flies are the carrier of cholera.

(vii) Microbes cause diseases.

(viii) The diseases caused by microbes can be prevented by some means.

Notes :

Gangrene :-

Deep sore causing dystrophy of muscles. It may develop in any wound which is left untreated and thus exposed to infection for a long time.

Anthrax :-

This disease spreads in animals through a bacteria known as *Bacillus anthracis*. This bacteria comes in animal by ingestion and inhalation. Generally this disease is seen in cow, buffalo, horse, sheep and goat.

Foot and mouth disease :-

This disease spreads through a virus. The main symptoms of this disease are high temperature (100° to 110°F) and saliva comes continuously from mouth.

Sludge :-

Sludge is a manure, which is prepared with the help a of waste product of human body.

Immunity -

The body shows resistance to the any foreign intrusion (examples a bacteria or virus). For this purpose, special kind of cells are produced in the blood which engulf the foreign particles and destroy. When a little quantity of foreign particle is introduced many of these special kind of cells, released for its destruction remain unused. These cells operate immediately when more foreign particles are in. These defensive cells of the body are specific for each kind of foreign particle. For example, immunity giving cells for small pox are different from immunity giving cells of cholera.

- (ix) Certain chemicals extracted from some living organisms are used for killing their organisms.
- (x) Vaccines are used for making the body immune.

2.3 Activities

S. No.	Title	Items required	Skills to be developed	Remarks
1	2	3	4	5
1.	To observe micro-organisms from bread(S).	Bread container (petridish), Forceps, Glass slides, Stand, Compound microscope.	Handling of material	Proper care should be taken in handling of micro-organisms and microscope.
2.	To study the micro-organisms present in <i>dahi</i> , and sugar solution(S).	Sugar solution, Dropper, Forceps, Glass slide, Microscope, <i>Dahl</i> .	Preparation of slide, Observation.	
3.	To study the nodules in pea	Microscope, Needles, Pea	Testing of the material and	Teacher may demonstrate the ac-

1	2	3	4	5
plant (D & S).	plant with roots, Forceps.	Slide preparatal.	activities, nodules can be seen from roots of any leguminous plant.	
4. To prepare <i>dahi</i> (D & S).	Milk, Starter, Heating device, Container, Spoon.	Experimental, Observation.	Teacher may demonstrate <i>dahi</i> formation, various effects on <i>dahi</i> and keeping in hot and cold place may also be mentioned.	

2.4 Relevance to daily life

The understanding of manure formation from dung of the cattle and vegetable wastes through microbial activity. Another example is preparation of *dahi* and the knowledge of various factors controlling the preparation of *dahi* helps us in our daily activities. The knowledge of microbes and their help in proper preservation of food to check the microbial growth.

The use of antibiotics with reference to the microbial diseases should be made with physician's help. The common vaccines used are produced from the micro-organisms which protect us from microbial diseases.

3. EVALUATION

Teacher may ask the students about

- (i) the role of *Rhizobium* with reference to nitrogen fixation.
- (ii) the role of mosquitoes
- (iii) the production of carbon dioxide in fermentation.
- (iv) the understanding of key terms and scientific principles.

4. REFERENCE MATERIALS

1. Life Sciences, A textbook for Secondary Schools, classes IX-X
NCERT, New Delhi.
2. Microbes - C.V. Subramanian, NCERT, New Delhi.
3. Plant Viruses—Anupam Verma, NCERT, New Delhi.

CHAPTER 43

CELL AND TISSUE

1. OVERVIEW

The children are already aware that all the living organisms, plants and animals are composed of cells. In this chapter they will learn more about cell-a basic unit of life. The cells are basically having similar structure in both plants and animals. The chapter also deals with chromosomes and important chemical D.N.A. which is responsible for the characters of the individual. The details of growth in plants and animals by mitotic and meiotic divisions have been covered in the chapter. In multicellular organisms, the cells group together to form different tissues which again combine to form different organs. They make different systems to perform different functions. The division of labour in the body cells of an organism and how it helps in efficient functioning has been discussed.

2. LEARNING OUTCOME

2.1 Key terms

Nucleus; Chromatin materials; Nucleus; Plasmalemma; Mitochondria; Vacuoles; Cellulose; Plastids; Cystolith, Raphides; Resins; Tannin; Alkaloids; Insulin; Dictyosome; Centrosome; Centriole; Differentiation; Mitosis; Meiosis; Chromosome; Autosomes; Sex chromosomes; Genes; Division of labour; Haemoglobin; Axon; Dendrite; Nissl's granules; Medullary sheath; Nodes of Ranvier; Synapse; Meristematic tissue; Cambium; Parenchyma; Chlorenchyma; Collenchyma; Sclerenchyma; Xylem; Phloem; Lactiferous tissue; Endoskeleton.

2.2 Major ideas and explanatory notes

- (i) Cell is the structural and functional unit of living body and all

the living bodies are made up of either cells or the products of the cells.

- (ii) There are certain structures common in plant and animal cells.
- (iii) Some structures are present only in animal cells and some only in plant cells.
- (iv) Some organisms are made up of only one cell.
- (v) A large number of cells are present in multicellular organisms.
- (vi) The shape of a cell in a multicellular organism depends upon its position and function.
- (vii) The size of the cell varies.

Note :

The size increases due to the growth of the cell. The unlimited growth in size do not permit proper functioning the cell.

- (viii) After certain period of growth, a cell divides into two daughter cells by a process called mitosis.
- (ix) Mitosis is more frequent in young organisms.

Note :

In adults, the mitosis occurs in the restricted regions of the body.

- (x) Mitosis occurs in all cells of the body and each mitosis results into two exact replica of the parent cell
- (xi) Meiosis occurs in the reproductive organs and each meiotic division results into the formation of four cells, each having half the number of chromosomes of the parent cell. Within a cell the nucleus contains chromatin materials which during division condense to form chromosomes.
- (xii) In each cell the chromosomes are present in pairs and some pairs of chromosomes are present in all cells of the body.
- (xiii) The number of chromosomes is same in all individuals of a species.

- (xiv) In each pair of chromosomes, the two partners are of same shape and size.

Note :

The teacher may explain the exception — one pair in males where one is large (X-chromosome) and other one is small (Y chromosome). This unequal pair is called sex chromosome (this is only true in males, in females the sex chromosomes are equal).

- (xv) Chromosomes contain genes.

Note :

Each pair of genes (one in each chromosome) control one character of the individual. Some characters are controlled by the actions of several gene pairs.

- (xvi) Each chromosome is made up of three chemical substances.

Note :

The substances are protein, DNA and RNA. The teacher may point out that DNA constitutes a gene.

- (xvii) The group of cells having similar structure and function is called tissue.

Note :

The teacher may extend it to organs and system. Several tissues aggregate and interact to form an organ. Several organs participate to form a system which serves one function.

- (xviii) The study of cells and tissues illustrates the extent of orderliness which exists in the living world and success of the orderliness lies in the co-ordination.

Note :

While developing the above mentioned major ideas it is necessary to ensure that students are equipped to understand all the future

discussions about the cellular level of organisation. Teacher may find following suggestions useful.

1. Teacher should explain that all the cells are holding together due to the presence of plasmalemma.
2. The words like alkaloids and resins should be clarified.
3. The teacher should explain the difference between a light microscope (compound) and an electron microscope.
4. Details about the structure of cells can be shown by charts, models and by drawing on black-board (teacher may refer Fig. 43.1 of textbook).
5. Functions of nucleus must be clearly explained (Hint: It serves as a controlling centre of all the activities).
6. The term Differentiation must be elaborated, the teacher will explain that the differentiation is not only structural or morphological but also functional. The structure changes and perform different functions.
7. Teacher may recall about growth in the previous chapter. The growth in organisms is faster in certain periods of their lives, because in young stage cell division is faster. During meiosis, in female, three daughter cells are destroyed and one remain as a reproductive cell.
8. While teaching mitosis teacher should explain the structure and function of various parts which have not been labelled in Fig. 43.4 in the textbook.
9. While teaching meiosis the teacher should explain chromosomes in more details.
10. Nerve cell :—All parts must be mentioned e.g. *Synapses* or *dendrites*.
11. Lymph and lymphatic system must be explained. The lymph is contained in certain vessels and cavities which constitute the

lymphatic system. The fluid part of lymph takes CO_2 from the tissues and supplies oxygen to the tissues. Fatty substances are transported through the lymphatic system. Lymph contains only one type of cells called white blood cells (WBC).

12. Teacher should explain the different functions of skin; Exchange of gases may take place through general surface of the body.
13. Chromosomes are always in pairs and they are identical and similar in function.
14. Some chemicals check the activities in the cell. Our knowledge about the chromosomes have helped us to understand the remedies of genetic diseases. Genes sometimes can be changed by artificial means for example by X-ray and by the application of some chemicals. Sometimes the chemical may improve the nature of the genes or quality of a gene.
15. All the muscles have property of contraction and relaxation but striated muscles contract and relax continuously.

2.3 Activities

S. No.	Title	Items required	Skills to be developed	Remarks
1	2	3	4	5
1.	To study growth in plants (S).	Potted plant of gram or bean (seedlings), Ink, Scale or thread for marking.	Measurement, Observation.	Mark equidistant transverse lines on root or shoot of bean seedling then grow in moist saw dust.
2.	To examine some plant and animal	Live frog, Dissection box, Hand lens, Dissecting tray, Micro-	Dissection, Observation.	Teacher may dissect a frog and prepare some sli-

1	2	3	4	5
	tissues (D&S). scope, Slides, Cock roach, Gram shoot, Leaf, some prepared slides of plant and animal tissues.			des of different tissues like blood, nerve, skin and some muscles.

3. EVALUATION

- (i) What are the controlling activities and how nucleus controls the activities of the cell?
- (ii) In both mitosis and meiosis the cell divides to produce more cells, what is the difference?
- (iii) What is the difference between plant cell and an animal cell?
- (iv) Why are the plants and animals exactly alike?
- (v) Why are the alurone, starch grains, tannin and resins present in some cells?
- (vi) Why are some of the animal cells spindle shaped? Does this shape has any functional significance?
- (vii) What is the difference between chromatin materials and chromosomes.
- (viii) What is a cartilage (as seen in ear and nose)?
- (ix) The significance of cell, tissue, organ and organ system?
- (x) Draw and label the different types of cells which you have seen in the figures of your textbook. From these sketches attempt to answer the following questions :—
 - (a) Which parts are common in all the cells?
 - (b) Which parts are seen only in plant cells?

- (c) Which parts are found only in animal cells ?
- (d) Why the cells are of different shapes ?

4. REFERENCE MATERIALS

1. Botany for Degree Students—A. C. Dutta. Oxford University Press, Delhi.
2. Life Sciences, A textbook for Secondary Schools, Classes IX-X—NCERT, New Delhi

CHAPTER 44

REPRODUCTION

1. OVERVIEW

The children are aware that organisms reproduce their own kind. The organisms do it by various means to perpetuate the species of plants and animals. The chapter deals with reproduction and reproductive organs in higher animals and plants. The reproduction by asexual means in many lower organisms where the whole individual divides itself into two parts—binary fission is also discussed.

The nature of reproductive activity in plants, animals and in human beings has been discussed. The understanding of human reproduction is important to check the rapid increase in the population of mankind. Such check is necessary because population increase is putting tremendous pressure on the available resources (e.g., food and space).

2. LEARNING OUTCOME

2.1 Key terms

Caterpillar; Pupa; Binary fission; Bud; Gemmules; Spore; Cyst; Regeneration; Androecium; Gynacium; Hermaphrodite; Pollination; Zygote; Seminal vesicle; Fallopian tube; Uterus, Vagina, Vulva; Ovulation; Menstruation; Fertilization; Embryo.

2.2 Major ideas and explanatory notes

- (i) All living organisms increase their number.
- (ii) There are different methods of reproduction.
- (iii) Vegetative reproduction is seen only in plants.

- (iv) Various types of asexual reproduction are seen in lower organisms.
- (v) Asexually reproducing forms have strong power of regeneration.

Note :

The teacher may point out that the regenerating property in higher organisms is only for replacement of lost parts or wound healing, it has nothing to do in the reproduction.

- (vi) Sexual reproduction takes place in both lower and higher organisms.
- (vii) There are certain special features in human reproduction.

Note :

The mention of absence of "heat period" or "reproductive season," menstruation cycle, parental care may be made.

- (viii) Child birth control is possible through various mechanical, chemical and surgical techniques.

Notes :

1. Teacher should also explain that there are some plants which are either male or female e.g. Papaya, Cucumber etc.
2. Teacher may explain the vegetative propagation with examples of natural and artificial propagation by cutting, grafting and layering of the leaf of *Bryophyllum* or the runner of a grass giving rise to new plants.
3. Teacher may explain plants which show regeneration. If the twigs of some plants are cut, they regenerate again e.g. China rose, Rose etc.
4. Teacher should explain the zygote formation with the help of diagrams on the blackboard or charts
5. The teacher may point out that the pollination is seasonal in most of the plants (flowering season). In most of the animals

also exists a specific season for reproduction. In human beings no such seasonality is observed

6. While explaining each major idea, teacher should encourage students to give examples from their own experiences. They will give many wrong examples. Instead of saying "no" to such answers, the teacher should explain why the answer is wrong. While teaching the structure and function of different organs the teacher may face certain questions which are to be carefully answered, for example, how sperm cells from men are transferred into the body of women? How child develops inside the body of the mother? etc. The teacher should speak the truth unemotionally. If necessary the teacher may say--"Like working of television or working of an electronic watch there are many things which are difficult to understand at this age. This is true for these questions also. The existing knowledge obtained from this chapter will help you to understand these questions after a few years".

But in no case, the teacher should tell anything which is false or myth or a half-truth.

2.3 Activities

S.No.	Title	Items required	Skills to be developed	Remarks
1	2	3	4	5
1.	To demonstrate reproductive parts of some animals(D).	Frog, Rat, Dissection box, Dissecting tray.	Ability to identify different organs and to draw.	The teacher may dissect and explain and also encourage students to dissect the animals.

1	2	3	4	5
2.	To show reproductive parts of plants (D & S).	China rose, Mustard flower, Needle and Hand lens.	Ability to identify the reproductive parts of the plants.	Teacher may mount anthers, filaments and carpel on the slide and show.

2.4 Relevance to daily life

Bees and other insects sitting on the flowers and helping in pollination, chicks hatching out the eggs and new borne kitten with their mother are some of the examples of their reproductive activity which happens around us.

This chapter will help the child to understand the following events in the environment.

- a. Reproduction is a life process which is meant for the increase of number. All living forms tend to increase their number.
- b. A number of agents like ants, bees and insects visit flowers. They help in pollination.
- c. The croaking of frogs during rainy season is caused by the male frogs to invite the females.
- d. The chick comes out of the egg after certain days of development inside the shell. During this development the hen provides required temperature by sitting on it.
- e. Many animals take care of their young. The number of young ones is less in the animals with some parental care e.g. bird, cat, dog and man. The number of offspring is more, where there is no parental care e.g. fishes and frogs.
- f. In most of the animals and plants reproduction takes place in a particular season only exception is human beings where no such restriction exists.

3. EVALUATION

- (i) How do the bees and ants help in the reproduction of plants?
- (ii) How can a new plant develop from the leaf of a *Bryophyllum*?
- (iii) Collect information from 10 families in your locality and find out how many children were born in the last ten years.

Note the months in which they were born. On the basis of your finding attempt to answer the following questions—

Is there any specific season or month for child birth?

What is the ratio of male and female child?

What is the nature of care provided to the children to grow?

Which age group of parents give birth to the maximum number of children?

Do you find that in some families there are long gaps between the birth of child? But in some families the gap is too short. Do you think that long gap is better for the care of the children than the short gap?

4. REFERENCE MATERIALS

1. Science, A textbook for Secondary Schools, Classes IX-X, Part II—NCERT, New Delhi.
2. Biology, A textbook for Higher Secondary Schools, Classes XI-XII, Parts I, II—NCERT, New Delhi.

CHAPTER 45

GROWTH AND DEVELOPMENT

1. OVERVIEW

The children in previous chapter have learnt that the animals and plants increase in number through reproduction. In this chapter they will know about growth and development; the two important processes which change the daughter individuals (seeds or fertilised eggs) into a fully formed one.

In plants processes like germination of seeds and growth of the plumule and radicle, occur during growth and development. Both these processes are dependent upon certain external and internal factors.

The chapter covers the process of development in animals where the fertilized egg or zygote passes through various stages to form an embryo. The embryo develops either directly or indirectly into a fully formed individual.

The children will learn that growth is a basic feature of unicellular and multicellular plants and animals during which increase in shape, size and weight takes place

The chapter also deals with growth and development which are the cellular processes in multicellular forms.

2. LEARNING OUTCOME

2.1 Key terms

Alternation of generations; Blastula; Gastrulation; Cleavage; Gastrula; Gastrulation; Grandperiod of growth; Hatching; Incubator,

Indirect development, Metamorphosis; Morphogenesis; Prothallus; Radicle; Tadpole stage; Tail-bud stage.

2.2 Major ideas and explanatory notes

- (i) Number of factors are involved in the process of germination
- (ii) Life cycle i.e. adult to adult, is simple in lower organisms.

Note :

In higher organisms the life cycle may involve phenomena like alternation of generations and metamorphosis.

- (iii) Development in all organisms is a cellular process.

Note :

In multicellular forms, the individual begins as a single cell stage and gradually develops into an adult.

- (iv) The growth varies in plants and animals.

Note :

In plants, the root and shoot tips retain the permanent capacity to grow. In animals growth ceases after certain period.

- (v) In both plants and animals growth depends upon genetic characters and hormone production.

Note :

In plants, proper light, water, temperature, nutrients and oxygen play an important role in the process of growth. In animals growth depends upon the supply of food.

- (vi) Parental care is seen only in animals. It helps in the proper growth of the young ones.

Notes :**1. Alternation of generations**

The phenomenon of alternation of generations in ferns has two stages *sporophytic* and *Gametophytic*. Sporophytic stage includes fern plants having rhizoids, petiole and spore bearing leaves. The spores are produced by meiosis and are haploid in nature. The spore germinates to form a stage called *Prothallus*. The prothallus represents the gametophytic stage and bears male and female gametophytes to produce male and female gametes respectively.

The union of male and female gametes gives rise to sporophytic stage which bears spores.

2. Metamorphosis

Transformation of eggs to larva and then finally to adult through a series of stages.

Reference of direct development may be pointed out by the teacher i.e. from embryo to adult as seen in animals including birds.

3. Egg case

When the eggs are laid they are covered by jelly like substance called egg case. Development upto larval stage takes place in this case.

4. Tadpole stage is converted into adult through series of changes in the body structure.

5. Teacher may explain that development in all plants is different from that of animals. The zygote of plant divides automatically to form a cell mass, where differentiation of different regions to form root and stem takes place.

6. Growth of hair and nails etc. is a growth but does not contribute to the total growth of the body. These are secretions of epidermal cells.

2.3 Activities

S.No.	Title	Items required	Skills to be developed	Remarks
1	2	3	4	5
1.	To demonstrate the different stages in germination of seeds (D).	Seeds (Monocots & dicots), Filter paper, Cotton.	To enable the students to understand the growth and development.	(i) Setting up of the experiment for germination requires advance preparation. (ii) Teacher may demonstrate the different stages of germination. (iii) Students will observe the germination of seeds and draw the diagrams. (iv) A chart can also be used.

2.4 Relevance to daily life

This chapter is expected to develop proper understanding about the following things and occurrences in the environment.

- a. Growth and development are seen in both plants and animals including man. Both these processes are dependent upon several factors. In plants water, light, temperature, air and minerals are the most important requirements. In animals including man supply of food having nutritive value and protection are the most important requirements,

- b. Growth and development continue in plants but in animals it ceases after certain period. Therefore, meeting the requirements of growth and development at the early stage is essential in animals. If the requirements are not met at the early stage, the growth and development will be retarded.
- c. Parental care plays an important role in proper growth and development of young animals. In some mammals, especially in human beings the care provides training to live effectively in the environment. The best parental care is possible only when the number of offspring is less.
- d. The ability to grow and develop varies in different individuals. For this reason for the purpose of cultivation, it pays to select seeds of better varieties. Similarly for domestic animals, the breeds from healthy parents are more useful.

3. EVALUATION

- (i) You want to germinate gram seeds, write how will you proceed?
- (ii) Some seeds were sown 30 cm under the ground, some 5 cm beneath the surface and some were left on the ground surface. In your opinion which seed will germinate properly. Can you give reason in support of your answer?
- (iii) What will happen if a seed is kept under water for long time?
- (iv) Why are the seeds kept stored in dry and sealed containers?
- (v) Can you find out the differences in the life cycles of fern and mango plant.
- (vi) In your opinion the life cycle of *Obelia* resembles more to which plant—fern or mango? Give reasons.

(vii) From your own observation write the differences in the development of frog and chick.

(viii) What is the difference between larva and embryos.

4 REFERENCE MATERIALS

1. Life Sciences, A textbook for Secondary Schools, Class IX-X—NCERT, New Delhi.
2. Science, A textbook for Secondary Schools, Class IX, Part I—NCERT, New Delhi.
3. Botany for Degree Students—A.C. Dutta, Oxford University Press, Delhi.

CHAPTER 46

HEREDITY AND VARIATION

1. OVERVIEW

With common experience that no two organisms are exactly alike children will learn about the transfer of characters to the next generation. They will also learn about the role of genes and cell division. The crossing over of chromosomes and the recombination of genes during meiosis are responsible for the production of variation in the next generation.

The children will appreciate the need of these variations for the successful survival of the organisms to cope with the various changes in the environment.

The chapter also deals with contrasting characters which lead to the formation of certain organisms called hybrids. In the hybrid, genes responsible for both the characters will be present but the expression of only one character will take place.

From the modern knowledge of genetics by manipulation of genetic material there is a possibility of correcting the hereditary defects as well as improved production of crops and better breeds of animals.

2. LEARNING OUTCOME

2.1 Key terms

Pedigree; Selective breeding; Poultry; Embryo; Hybrid; Dominant; Recessive; Phenotype; Genotype; Genetic engineering; Colour blind; Haemophilia; Variation; Heredity.

2.2 Major ideas and explanatory notes

- (i) Variation is found in all plants and animals.

Note ;

Excepting the identical twins which develop from the division of the zygote, no two living organisms are exactly alike.

- (ii) The inheritance of characters from one generation to the next, obey certain laws.
- (iii) Two organisms may be phenotypically similar but genotypically different.
- (iv) The behaviour of chromosome during meiotic division is responsible for the variation.
- (v) After the discovery of the molecular structure of D.N.A. (a chemical substance which constitute gene), it has been possible to understand the mechanism of gene function.
- (vi) Some disorders of man are genetic but not all. It is possible to overcome many genetic disorders.

Note ;

The teacher should elaborate the following points.

1. Meiosis

This process of cell division should be taught carefully. The crossing over and recombination should be properly explained for the understanding of the production of new varieties. These recombinations produced by crossing over, are segregated in the parents, during the formation of gametes.

2. Selective breeding

Parents possessing desired characters are selected so that offspring may also have these characters.

- a Resistance to diseases.
- b More fruit bearing plants.
- c Hens producing large sized eggs.

2.3 Activities

S. No.	Title	Items required	Skills to be developed	Remarks
1	2	3	4	5
1.	To study the variations in human being(S).	Pencil, Notebook.	Observation, Collection of data.	The following characters may be taken up for study. Ear lobes free/fused, Eyebrow joined/free, Nature of hair. Ability to roll the tongue. Teacher may explain that only these characters are chosen because these are genetically inheritable. Take children of the same age group. Fused ear, Joined eyebrow and rolling of tongue are recessive characters
2.	To study tolerance of seedling to environmental factors(S).	Seed, pot, water.	Observation, To set up experiment, Collection of data.	To understand that tolerance to draught conditions varies in different plants.
3.	To demonstrate Mendel's laws with a chart or checker board (D).	Chart and black board	Observation, Calculation.	Explain the terms dominant, recessive phenotype, genotype.

1	2	3	4	5
4.	To study the germination of gram pea bean and other legumes under identical conditions (S).	Gram, Pea, Bean, Petri dishes.	Setting up of experiment, Observation.	Teacher may explain that although all of them belong to the same family still there are many differences

2.4 Relevance to daily life

Long before the modern knowledge of heredity, human beings were breeding horses and other domestic animals for good varieties. The expansion of one knowledge about heredity and genetics saw the coming of many improved varieties of plants and animals. We are looking forward for further improvement.

The understanding of heredity has established the equality of all human beings irrespective of their colour and other features. This has helped in minimising the racial discrimination. It has now been realised that with equal opportunity all human beings can behave equally and there is no reason to believe any kind of basic discrimination between men. The problems created due to colour or caste are just political issues and have no scientific basis.

3. EVALUATION

- (i) Pea plants having smooth seeds (SS) and wrinkled seeds (ss) are crossed. What will be the ratio of phenotypes and genotypes of offsprings ?
- (ii) If T represents tallness and t dwarfness write down the phenotype and say whether they are pure or hybrids.

4. REFERENCE MATERIALS

1. Biology, A textbook for Higher Secondary Schools, Class XII, Part II, Vol. I—NCERT, New Delhi.
2. Heredity—David N. Bonar, S. Chand & Company, Delhi.
3. General Genetics—Adrian M S.B, Ray D Owen & Robert. S. Edger, S. Chand & Company, Delhi.

CHAPTER 47

ORGANIC EVOLUTION

1. OVERVIEW

Life on earth came from non-living materials and all the living organisms had a common origin. The diversities came later. A wide variation exists within living organisms and even within a species, the scientists explained the origin of these variations through the theory of organic evolution. According to this theory, life originated from a speck of substance and all the different forms that we see today have gradually developed from the pre-existing forms.

There are different theories of organic evolution. Theories of Darwin and Lamarck have been discussed extensively.

Evidences in support of the theory of organic evolution are drawn from morphology, physiology, taxonomy, embryology and geology. Thus understanding of this chapter will require previous knowledge about the structure and function in plants and animals.

2. LEARNING OUTCOME

2.1 Key terms

Acquired changes; Analogous structures; Anatomy; *Archeopteryx*; Developmental biology; Ecology; Embryology; Fossils; Genetics; Geology; Homologous organs; Morphology; Natural selection; Organic evolution; Physiology; Sedimentary rocks; Struggle for existence; Survival of the fittest; Use and disuse; Vestigial organs.

2.2 Major ideas and explanatory notes

- (i) Variations exist within the living organisms.
- (ii) All living organisms have same physical basis of life.
- (iii) All living organisms have a common origin and diversity came later.
- (iv) Diversities in life can be explained through organic evolution.
- (v) There are several evidences of evolution.
- (vi) Lamarck's theory of evolution is based on the use and disuse and transfer of acquired characters from one generation to another.
- (vii) Darwin's theory of evolution is based on universal occurrence of variation, high rate of reproduction among living objects which leads to struggle for existence. Ultimately survival of the fit-test leads to the origin of new species.
- (viii) *Archeopteryx* and *Archaeornis* are two fossils of birds found in upper jurassic period. They had the characters of both birds (wings and feathers) and reptiles (teeth and tail). Scientists believe that birds originated from some ancestors having *Archeopteryx* like features.
- (ix) Life originated first from non-living materials but since then living things always came from pre-existing life.

Note :

In order to understand the origin of life from non-living materials, the scientists are doing experiments in the laboratory. At the same time search for living substance, on different planets is also going on.

Notes :

1. Understanding of organic evolution is a difficult concept. The

misunderstanding has resulted into misbeliefs, wrong interpretation and unjustified actions. The common misunderstandings are—"man originated from monkeys", "struggle for existence and survival of the fittest means survival of the strongest" etc. Teacher should take proper care in explaining the concepts.

2. Teacher should keep in mind that at the time of Darwin, cytology, genetics and embryology were undiscovered. Future discoveries in these areas helped us to understand the mechanism of variation and its transfer from one generation to other. All these findings have strengthened Darwinism.

2.3 Activities

S.No.	Title	Items required	Skills to be developed	Remarks
1	2	3	4	5
1.	To observe and list various vestigial organs in men(S).	Charts on vestigial organs, Pencil, Notebook.	Observation, Identification.	Children may be asked to draw from the charts.
2.	To list homologous and analogous organs of man(S).	Pencil, Notebook.	Identification, Listing.	Prepared charts may be shown to the children.

Note :

Teacher may arrange a visit to a zoo or museum and natural history museum.

2.4 Relevance to daily life

The same environment is shared by human beings with other living organisms. A continuous interaction is going on between different organisms e.g. between man and animals, man and plants, animals and plants, animals and animals, plants and plants and between human beings. Through

intelligence human beings have taken upper hand over other organisms and for their survival they are exploiting not only plants and animals but also other fellow beings. This has resulted into a number of problems like pollution, shortage of resources, poverty, malnutrition and disease. All these problems are threatening mankind. Only possibility to avert this danger is collective and cooperative action of all the citizens. The proper understanding of organic evolution is especially relevant for such collective and co-operative actions. Most important lesson one gets from organic evolution is to realise that survival of an individual or a group is not important but most important concern is the survival of the species.

3. EVALUATION

- (i) Write the name of some homologous and analogous parts in plants.
- (ii) How were the following organs formed? Discuss them in terms of use and disuse: Limbs of snake, webbed feet of duck, feet of leopard.
- (iii) Explain the evolution of the long necked Giraffe from short necked one, with the help of Darwin's or Lamarck's theory?

4. REFERENCE MATERIALS

1. Science, A textbook for Secondary Schools, Class X, Part II —NCERT, New Delhi.
2. Rocks unfold past—V. Mitra, NCERT, New Delhi.
3. Science and Society, A Supplementary reader—NCERT, New Delhi.

CHAPTER 48

MATERIALS-I

1. OVERVIEW

The children are familiar with some physical and chemical properties of materials and some of their uses, for example use of iron in making steel. In this chapter they will learn about formation of alloys and characteristics of alloys.

The chapter also deals with some basic properties of ores, rocks, minerals, and extraction of metals from their ores. Physical and chemical properties of metals have also been discussed.

The children will study corrosion of metals and their protection through method of tinning, galvanising and electroplating.

2. LEARNING OUTCOME '

2.1 Key terms

Minerals; Ores; Extraction of metals; Concentration; Gangue; Roasting, Malleability; Ductility; Metallic lustre; Alloys; Corrosion; Tinning, Galvanisation; Electroplating.

2.2 Major ideas and explanatory notes

- (i) Minerals are homogeneous substances.
- (ii) Minerals are obtained from different sources.

Note :

The teacher may list the following sources of minerals-oceans, lakes, rivers, rocks and ponds.

- (iii) Minerals are of various kinds.

Note :

Some minerals help in the growth of plants.

- (iv) The ores are the source of metals.

Note :

Generally ores of metals occur in the form of sulphides, oxides and carbonate, e.g. copper pyrites (Cu_2FeS_2), aluminium as bauxite (Al_2O_3) and Iron as haematite (Fe_2O_3).

- (v) Metals are extracted by different methods.

Note :

The unwanted impurities such as rocky matter, sand etc. are removed by the process of concentration and roasting.

- (iv) Metals exhibit certain physical properties.

Note :

Some metals such as gold and silver can be rolled or beaten into sheets. This property is called malleability.

Note :

Some metals can be drawn into thin wires. This property is known as ductility. Owing to the above the metals can be changed into different shapes according to our needs.

- (vii) Metals also have certain chemical properties.

Some metals combine with oxygen (air) to give oxide for example: Magnesium wire burns in air and forms magnesium oxide: $2\text{Mg} + \text{O}_2 \rightarrow 2\text{MgO}$

When copper is heated in air it gives copper oxide; $2\text{Cu} + \text{O}_2 \rightarrow 2\text{CuO}$, Sodium reacts with water and forms sodium hydroxide and hydrogen hence it is kept immersed in kerosene oil;



2. In rainy season iron gets rusted due to corrosion.

(viii) Corrosion of metals can be prevented.

Notes :

1. **Oiling** : Iron utensils are dried properly after cleaning and then oiled.

2. **Tinning** : Copper vessels are protected by molten tin. This process is called tinning.

3. **Galvanisation** : Iron sheets are dipped into molten zinc. This is called as galvanisation.

(ix) Alloys exhibit certain properties.

Note :

A homogeneous mixture of metal with another metal or with a non-metal is called an alloy. Alloys are more hard than metals and less malleable and ductile than their components. Stainless steel is both acid-proof and rust-proof alloy.

2.3 Activities

S. No.	Title	Items required	Skills to be developed	Remarks
1	2	3	4	5
1.	To study physical properties of some metals(S).	Copper and aluminium wire, Copper, aluminium, Zinc, plates, Heating device.	Experimental, Observation.	
2.	To study the activity of some metals(S).	Dilute HCl, Strips of different metals, (copper, zinc, magnesium, iron).	Experimental, Observation.	

1	2	3	4	5
3.	To observe the phenomenon of corrosion and its prevention(S).	Iron strips, Watch glass, Distilled water, Tap water, Grease.	Experimental, Observation.	
4.	To observe the oxidation process (D).	Aluminium strips, Magnesium ribbon, A pair of tongs, Heating device, Mercuric chloride, pointed needle.	Observation	

2.4 Relevance to daily life

There are common experiences in our daily life where the knowledge of metals helps us. We find that broken metal utensils are sold in the market. It is possible to recycle them. Malleable nature of metals helps us to get cooking utensils. We find that aluminium foils are used to wrap chocolates.

By alloying, metals become more hard, rust-proof and ductile for longer time, for example stainless steel is very useful these days.

3. EVALUATION

The teacher may ask the following questions.

- Why do we use copper and aluminium wire in electric circuits ?
- How do we repair a broken iron or copper utensil ?
- Why do we prefer steel vessels as compared to utensils made of brass, iron, copper or aluminium ?

4. REFERENCE MATERIALS

- Science, A textbook for Secondary Schools, Class X, Part II—NCERT, New Delhi;
- Chemistry, A textbook for Higher Secondary Schools, Classes XI-XII—NCERT, New Delhi.

CHAPTER 49

MATERIALS-II

1. OVERVIEW

The children are aware of the uses of synthetic materials e.g. plastic, synthetic fibre (nylon) and glass. The chapter deals with the properties and uses of synthetic material for example plastics are resistant to corrosion, films are made from celluloid. They will also learn about glass, its composition and different kinds of glass such as flint glass, bottle glass etc. The manufacture of ordinary glass is also discussed.

2. LEARNING OUTCOME

2.1 Key terms

Synthetic materials; Terylene, Dacron; Cashmilon; Plastics; Polymerisation; Celluloid; Glass; Hard glass; Flint glass; Bottle glass; Pyrex glass; Ground glass; Glass wool; Rotary furnace.

2.2 Major ideas and explanatory notes

- (i) Synthetic materials are the mixtures of two or more substances.

Note :

The teacher may give the example of rayon. It is obtained by mixing copper sulphate, sodium hydroxide, ammonia and sulphuric acid to cotton, wool or waste papers etc. which contains cellulose.

- (ii) Plastic is of different types.

Note :

Plastics are the polymer compounds having large molecules.

- (iii) Plastics have large number of uses.

Note :

Plastics have replaced wood, metal, glass and stoneware for making toys. Electric switches are made of bakelite.

- (iv) Glass is a mixture of substances.

Note :

Ordinary glass is a homogeneous mixture of some substances, By heating sand with sodium carbonate and lime stone a mixture is obtained which solidifies on cooling to form glasses. It has no definite composition. There are various kinds of glasses.

- a **Hard glass** is more resistant to water and acid it contains silicate of potassium and calcium.
- b **Flint glass** is transparent and is used in making electric bulbs.
- c **Bottle glass** is a soda lime glass.
- d **Pyrex glass** is a mixture of some salts of zinc and barium. It is heat proof.
- e **Ground glass** is used in houses and hospitals and for making air tight glass apparatus.

The teacher may explain the manufacture of ordinary glass with the help of following. Sand (silica), soda ash (Na_2CO_3) and lime stone are mixed together and heated up to 1400°C in rotary furnace. On slow cooling this liquid forms glass.

2.3 Activities

S. No	Title	Items required	Skills to be developed	Remarks
1	2	3	4	5
1.	To recognise some materials by their burning odours(S).	Nylon, Cotton Cloth, Rubber, Wool, Leather, Polythene,	Experimental, Observation.	

2.4 Relevance to daily life

We find that the synthetic materials are put to different uses. For example terylene and nylon are used for making clothes, cashmilon is used in winter. Plastic is also used for manufacturing articles of day to day use. Glass is used everywhere in laboratories, hospitals and homes.

3. EVALUATION

The teacher may evaluate children's knowledge about synthetic materials.

- (i) Which glass is used for making window panes ?
- (ii) Why is nylon harmful for skin ?
- (iii) Why broken plastic articles are recycled ?

4. REFERENC MATERIALS

1. Science, A textbook for Secondary Schools, Class X, Part II
—NCERT, New Delhi.
2. Chemistry, A textbook for Higher Secondary Schools, Classes XI-XII—NCERT, New Delhi.

CHAPTER 50

AGRICULTURAL PRACTICES AND IMPLEMENTS

1. OVERVIEW

Ours is an agricultural country and nearly 80 percent of the population depends on agriculture for their livelihood. As such it makes the basis of our national economy. Various agricultural practices (ploughing, sowing, irrigation, manuring, plant protection, harvesting and threshing etc.) are undertaken in the fields. To acquaint the students with these operations will help them to understand the basis of agriculture. This will also help in understanding the recent scientific advancements in agricultural technology to raise the agricultural production.

2. LEARNING OUTCOME

2.1 Key terms

Agriculture; Agricultural practices; Agricultural implements; Field; Fencing; Overturned; Tillage and ploughing; Mud pieces or crumbs; Hard soils; Pressing the soil; Nursery; Broadcasting; Seed-drills; Furrow; Transplanting; Seed corporation; weeding; Harrow; Weedicide; Manuring; Mineral nutrients; Fertiliser; Irrigation; Watering; Percolation; Water sources; Retain; Sprinkler; Water logging; Drainage; Shrivelling; Furrow irrigation; Basin-irrigation; Terraces; Crop protection; Locust swarms; Pest; Pesticide; Scare away; Dummy; Harvesting; Threshing; Hay; Chaff; Winnowing; Sickle; Storage; Godown; Bins; Grainaries; Cold Storage.

2.2 Major ideas and explanatory notes

- (i) All the agricultural practices in general are must for each crop but vary from crop to crop.

- (ii) All the practices are followed sequentially.
- (iii) These practices require certain implements.
- (iv) Frequency of each practice differs from crop to crop.
- (v) Agricultural implements need proper care and maintenance.
- (vi) The crop after harvest needs proper storage and preservation.

Notes :

The teacher may explain the various terms and practices with the help of following information.

1. Mud-walls are the small bunds around the field prepared with soil.
2. Crop fields are ploughed time and again to make the soil friable, weed free and properly levelled to develop a ideal seedbed for proper germination, growth, development and yield of the crop. Soil if ploughed in a dry season, big and hard clods (soil clumps) are formed.
3. For sands and light soils (Rajasthan) one needs light shallow wooden or iron ploughs but for heavy clay soils deep penetrating and soil turning ploughs are preferred.
4. Ploughs made of wood and iron need proper care for their maintenance. After use they should not be kept in sun or rains and they should be properly cleaned. In case the blades are rusted due to being kept in open it should be cleaned with iron files or by rubbing with bricks. After use it may be greased.
5. Removal of upper soil layer by rains and winds are termed as water erosion and wind erosion respectively.
6. Leveller makes the field plain by scrapping soil from the higher spots and putting it at low lying spots. This helps in quick and uniform distribution of irrigation water. Levelling also compacts the upper soil and thus helps in checking the loss of moisture from the soil.
7. Putting the crop seeds in a well prepared soil for germination is called sowing. At sowing one must ensure sufficient moisture around the sown seed for proper and timely germination. Sowing is done by different methods.

(i) *by hand broadcasting* :- The seeds are spread uniformly by hand in the field and mixed up into soil. (ii) *Kera method* :- The seeds are dropped by hand in the furrow, behind the plough and is followed by planking, with the help of helper. (iii) *Pora method* :- seeds are dropped through a funnel with pipe attached with the back of the plough and it is not followed by planking. (iv) *Seed drills* :- (bullock drawn or tractor drawn) : Bullock or tractor is attached with a seed box opening into 6-7 iron pipes for uniform distribution of seeds at proper depth and spacing.

Sowing depth of seeds vary according to size of the seed, type of soil, moisture and climatic conditions of the area. Bolder the seed deeper is the sowing, for example mustard seed is sown shallower (4-5cm) under irrigated conditions but deeper (5-7cm) in dry areas.

8. The teacher may give *Dub* grass as an example of weed in the kitchen garden and the fields. In case of weedicides the students may be told about 2, 4-D, a chemical used to kill all broad leaved weeds in wheat crop without any injury to the crop.

9. We open account in the banks. We can withdraw only what is deposited. For further withdrawal, we have to deposit another amount. Similarly crop plants take out the nutrients from soil for growth. So for getting another crop we have to replenish the shortage of nutrients created by the previous crop. Fertilisers like urea can supply one or two nutrients but manures like farm yard manure can supply most of the nutrients needed by the crop. Fertilisers are manufactured by big factories but manures are prepared from vegetable and animal wastes.

10. Ample soil moisture is needed in the crop root zone for successful crop production. The main sources of irrigation water are rivers, canals, wells, tube wells, tanks, lakes etc. Water lifts are the means through which water is lifted from the source (canal, tanks, wells) where water level is much below the ground level. Water lifts commonly used are persian wheel, swinging

basket, lath. (bamboo attached with a weight and bucket to lift water from wells). Water is lost very fast through percolation. In rocky and unlevelled lands, sprinklers have proved to be a boon since it is difficult to prepare water channels and carry irrigation water to such rocky, slopes and uneven fields.

11. The soil gets water logged when it is saturated and cannot hold more water due to excess of water. The roots of growing plants feel suffocated due to less available air and plants start dying.

12. Drainage is the means of removal of excess water from the soil causing waterlogged condition. Such water can be removed by surface dug channels (surface drains) or by laying down row of earthen round tiles under the ground. These act as channels for taking out the excess water (sub surface drains).

13. In any crop flowering stage is most critical stage for irrigation. At this stage the crop must be provided with simple moisture otherwise the yield of the crop suffers. As an when the crop shows wilting or drying symptoms the crop should be irrigated.

14. Furrow irrigation water is applied through the furrows (ditch between two ridges or bunds). This is practised in crops like sugarcane, potato and vegetables grown in rows and on bunds.

2.3 Activities

S. No.	Title	Items required	Skills to be developed	Remarks
1	2	3	4	5
1.	To observe the effect of depth on seed germination (S).	Seeds, Pots (3), Scale.	Experimental, Observation.	The children may try different depths with seeds of local crops.

1	2	3	4	5
2.	To study and collect some crop plants, weeds and study their relationship (S).	Hand lens, Forceps, Needle, Scissors, Khurpi.	Collection, Observation.	The teacher may point out that weeds may cause allergy in human beings.
3.	To collect and study soils samples from different places (S).	Polythene bags, Khurpi Hand lens.	Collection, Experimental, Observation.	The teacher may demonstrate the properties of soil.
4.	To list different field operations carried out by farmer (S).	Pencil, Note book.	Discussion, Collection of information.	Students should be encouraged to talk to farmers.
5.	To study and list five farm implements (S).	Note book, Charts.	Observation, Drawing.	The teacher may, give actual experience of implements used by the farmers. Students may learn different parts and draw.
6.	To study the effect of irrigation on the growth of seedlings (S).	Seeds, Pots, Mug, Bucket, Water.	Experimental, Observation.	Students may try with heavy and normal irrigation.
7.	To study storage of grain in the villages and godowns (S).			Teacher may organize trip to godowns. Students may also observe in their own homes.

2.3. Relevance to daily life

Agriculture is the profession of most of our people. Every body needs food. We have achieved self sufficiency in food production. We all have to depend on agriculture not only for food but also for clothing and other industrial products. It is imperative to know the processes and implements employed in agriculture.

3. EVALUATION

The teacher may ask the following from the students.

- (i) Name one important agricultural operation which differs in two crops (wheat & paddy).
- (ii) Name methods of irrigation. Which method will you adopt for potato, sugarcane and rice. ?
- (iii) Why weeding is done ? Name the implement which helps weeding.
- (iv) Why we dry the grains after threshing and winnowing? (Hint: The grain if contains more than 15% moisture it will face insect attack during storage and it affects its viability)

4. REFERENCE MATERIALS

1. Indian Farming--A monthly journal, ICAR, New Delhi.
2. Kheti--A monthly journal, ICAR, New Delhi.
3. Handling and storage of food grains--S.V. Pingale, ICAR, New Delhi.
4. Our Agriculture--S K. Mukerji, NCERT, New Delhi.
5. Booklets released by Fertilizer Association of India, New Delhi.

CHAPTER 51

OUR CROPS

1. OVERVIEW

The Children have studied different agricultural practices followed in crop production. Some practices differ from crop to crop. Not only this, if we look to the crops growing in different fields and parts of our country we find crops differ from soil to soil, season to season and place to place. The chapter deals with different crops and their requirements fertilisers, irrigation and plant protection measures. The knowledge and understanding of these facts will form the base for the study of the recent advancements made in developing new varieties, improving the soil fertility and plant protection measures

2. LEARNING OUTCOME

2.1 Key Terms

Crop; Crop plant; Orchards; Cash crops; Crop yield; Hectare (2.47 Acres or 10,000 sqm); Kharif crop; Rabi crop; Decomposition; Compost, Plump, Line sowing; Japanese weeder; Symptom; Root knot disease; Seedborne disease; Blast disease; Pests; Hatching; Larvae; Green manure; Late sowing; Crust; tiller formation; (emerging shocks from the base of the main plant); Grain filling stage; Rust; Smut; Treading; Fodder; Chaff; Shelled; Crop rotation; Mixed cropping; Intercropping; Tikka or Leaf spot disease, Berseem; Bolls; Pickings; Variety; Caterpillar;

2.2 Major ideas and explanatory notes

- (i) Each crop has its own requirements of soil, water and nutrients.

- (ii) Crops are classified on the basis of season in which they grow and the type of products obtained.
- (iii) Various agricultural practices vary from crop to crop.
- (iv) The disease causing organisms and their control measures are general as well as specific for each crop.
- (v) Some weeds are common to many crops while others are specific for certain crops.
- (vi) Storage plays an important role in maintaining healthy seeds and grains.

Notes :

The teacher may use the information given below for elaborating various points.

1. Field crops may be grouped as :
 - (a) cereals food grain crops—(wheat, maize)
 - (b) cash crops—money making crops (sugarcane, tea)
 - (c) fodder crops—for cattle—(berseem, jowar)
 - (d) fiber crops—for fibre—(cotton, jute)
 - (e) pulse crops—for human consumption (gram, beans)
 - (f) vegetable crops—(Brinjal, tomato)
2. Crops may differ from soil to soil :
 - (a) Sandy soils—Curubits (kadu)
 - (b) Loamy soils—Wheat, maize
 - (c) Heavy soils—Paddy, jute
 - (d) Hilly soils—Tea
 - (e) Saline soils—Barley
3. Crops may differ from season to season kharif crops, rabi crops but some crops are grown in all the seasons in certain areas, e.g. maize, vegetables like lady's finger and tomato are grown the yearround.

4. One has to plough the soil repeatedly in stagnant water for rice. It is termed as puddling. This is done to fill all the soil pore spaces with water, which helps in reducing percolation of water, controlling weeds, and providing anaerobic (oxygen free) conditions in the root zone.
5. Alternate wetting and drying is a method of watering rice fields. The rice field is watered and water is allowed to stand for 2-3 days before it is let out and after a day or two again field is watered. This process is repeated. This helps in increasing both the availability of nutrients and also the root respiration.
6. Harvesting stage is a stage when the crop is drying out. It looks yellow and grains can be separated from ear heads by rubbing with hands.
7. There are two seasons in a year (kharif, rabi). If the land is cropped in one season and kept uncropped in second season, it is called fallowing. This rest to land is given for recouping the soil fertility reduced by cropping. Now a days, since lot of fertilisers and manures are available and new technology is at command, fallowing has proved to be an uneconomic preparation.
8. Sowing the wheat crop later (December) than proper time is called late sowing. This is done due to delayed harvest of the kharif crops (maize). The yield of late sown crop is less than that of timely sown crop, because in former case the crop gets less time to mature and tiller formation and thereby growth of the crop is reduced. To compensate late sowing 20-25 per cent extra seed is sown than the normal.
9. In wheat there are many critical stages for irrigation. The most important is CRI (Crown root initiation) stage appearing around 20-25 days after sowing. This crown root appears, 20-25 days after sowing, just below the surface. If the moisture in the soil

is not sufficient the plant will not tiller tremendously. Other stages are tillering, jointing, dough and milk stage.

10. Lodging as in wheat is the bending and falling of crop plants at grain billing stage, just after heavy irrigation, heavy shower and hailstorm. This usually occurs in tall straightened plants and highly fertile soils. This causes heavy reduction in grain production. Heavy irrigation should not be given around grain maturing and during fast blowing winds.
11. In earthen bins for grain storage polythene sheets are embedded on the walls just to check the moisture entry into the bins.
12. When seeds of two or more crops are mixed together and sown in the field it is called mixed cropping. This is adopted to ensure against complete crop failure e.g. wheat + barley + gram.
13. Growing of short duration crops like urd and moong in between the two rows of widely spaced crop (maize, sugarcane, cotton) to utilize the unused resources like land space, applied water, nutrients and light in the interrow spaces is known as intercropping. Intercrops give additional profitable yield without harming the main crop. These crops mature and are harvested before the main crop spreads and covers the interrow spaces.
14. Crop rotation is growing of more than one crop in succession in the same field for a definite period of time. One year rotation: Maize → fallow → Maize → wheat. Two years rotation: Maize → Wheat → Arhar → Wheat.

2.3 Activities

S. No.	Title	Items required	Skills to be developed	Remarks
1	2	3	4	5
1.	To study the practice of selecting healthy seeds (S).	Beakers, Seeds, Water, Salt.	Observation, Experimental.	Students may try with different seeds.

1	2	3	4	5
2.	To observe some common crops and classify them based on the use and season (S).	Picture cards showing different plant products, Pencil, Notebook.	Observation, Comparison	
3.	To observe the various stages of growth of some common crops (S).	Seeds, Soil, Petri-dish, Beakers, Pots.	Experimental, Observation.	
4.	To visit the field or Kitchen garden to list crops and record the average yield kg/ha (S).	Pencil, Notebook.	Observation, Identification, Collection of information.	
5.	To observe compost making by visiting dairy farms (S).	Pencil, Notebook.	Observation	Students may observe in their own village.
6.	To demonstrate collection and preservation of some diseased crop plants (D).	Polythene bags, Plastic bags, Herbarium sheets, Jars.	Collection, Preservation.	
7.	To study root nodules in some common leguminous plants (S).	Gram, Pea and other legumes with roots.	Observation	

2.4 Relevance to daily life

Our daily needs of grains, oils, clothes etc. are fulfilled by crops. The recent advances in crop production techniques have made India self sufficient in food. The fast increasing human and cattle population is a social problem since man has to strive for arranging food for them. This leads to new advancements for increasing the food production.

3. EVALUATION

The teacher may ask the following from the students.

- (i) Why some crops are grown in kharif season and some during the rabi season ? Some are found in light soils while others are grown on heavy soils.
- (ii) What is the most critical stage for irrigation in wheat ?
- (iii) What is difference between farmyard manure and green manure ? How would you prepare compost from farm wastes ?
- (iv) What crop rotations farmers follow in your locality ? List them.
- (v) Differentiate mixed cropping from intercropping with suitable examples.
- (vi) Why do we use higher seed rate in late sown than timely sown wheat crop ?
- (vii) Why soil crust is broken after sowing of seeds (to help the seeds to come out of compact hard soil surface due to rains)
- (viii) Why do we give more row spacing in spreading crop varieties than those which are sown in rows ?

4. REFERENCE MATERIALS

1. Improved implements for rice growing in rain fed areas : Farm Bulletin No. 2/1976, Extension Directorate of Ministry, New Delhi.
2. Weeds of North India—R.K. Arora, P K. Khanna, Ranvir Singh, Extension Directorate of Ministry, New Delhi.
3. Pests of rice and their control—J.P. Kulshrastha, Extension Directorate of Ministry, New Delhi.
4. Horticulture in Central India—H. Venkatratnam, Extension Directorate of Ministry, New Delhi.
5. Our Agriculture—S.K. Mukerjee, NCERT, New Delhi.

CHAPTER 52

IMPROVEMENT OF CROP PRODUCTION

1. OVERVIEW

The children have studied about different crops and have come to know that different crops differ with soil, climate and place. The crop production practices also differ from crop to crop. The children will learn about major factors responsible for raising crop production like crop improvement (breeding) and developing new high yielding, disease resistant varieties, soil improvement (manuring, fertiliser application, soil correction) plant protection measures (control of insects and diseases). These measures help in raising crop production.

2. LEARNING OUTCOME

2.1 Key terms

Draught; Replenished; Resistant; Breeding; Hybridization; Emasculation; Stock; Soil amendments: Humus; Texture and structure of soil; Mechanical analysis of soil; Saline soil; Alkali soil; Leaching; Ammonium sulphate; Sodium nitrate; Hygroscopic; Mixed fertiliser; Nodule; *Rhizobium*; Plant protection; Residual effect; Biological control.

2.2 Major ideas and explanatory notes

- (i) Crops need improvement both qualitative and quantitative from time to time.
- (ii) Various factors are responsible for better yield.
- (iii) The knowledge of soil, use of fertiliser and plant protection measures helps in increasing the crop production.

- (iv) Quality of crops in terms of yield, nutritive value and resistance to diseases can be improved through breeding.

Notes :

1. Improvement of crop production deals with the major factors which contribute in raising crop production like plant breeding, soil improvement, plant protection etc.
2. In the same crop varieties are bred for specific climatic conditions or for specific purposes (disease resistance) For example *Kalyan*, *Sona* and *Sonalika* are recommended for timely sowing and late sowing respectively.
3. The teacher may clarify that the soil amendments are not application of fertilisers and manures to improve the soil, rather these are the use of soil correcting chemical compounds. For example for correcting acidic soil, lime (calcium carbonate) is applied while for correcting alkaline soil gypsum (calcium sulphate) is used
4. Fertilisers are applied by different methods (i) broad-casting (ii) spraying (iii) putting in the irrigation channel (iv) placing in the root zone through funnel attached with plough or seed drill.
5. Mixed fertilisers contain more than one nutrient in fixed ratio e.g. CAN, NPK etc.
6. Seeds treated with insecticide or fungicide should not be consumed by man and animals even after washing.

2.3 Activities

S. No.	Title	Items required	Skills to be developed	Remarks
1	2	3	4	5
1.	To study the properties of soil (5).	Glass cylinder (4), Funnel (3), Filter paper, Red and blue litmus paper, Soil samples,	Setting up of apparatus Observation.	Samples may be collected from different areas.

1	2	3	4	5
2.	To demonstrate process of emasculation (D).	Potted flowering plant, Forceps, Polythene bags, Thread.	Experimental, Observation.	
3.	To collect and study different kinds of fertilisers (S).	Specimen bottles, Fertilisers, Petri dishes.	Collection, Observation.	
4.	To collect seeds of common crops and classify them based on variety and season (S).	Polythene bags, Plastic bottles.	Collection, Observation, Classification.	
5.	To observe various zones of soil profile on a construction site (S).	Dug up soil.	Observation, Identification.	
6.	To study nitrogen deficiency symptoms in maize (S).	Barthen pots, Maize seeds, Nitrogenous fertilisers.	Experimental, Observation.	Students can dig up deep pit to observe.

2.4 Relevance to daily life

Tremendous increase in food grain production has been witnessed during last few years. This has been mainly due to breeding and developing new high yielding disease resistant varieties, use of manures and fertilisers and adoption of effective plant protection measures. This has led to the self sufficiency in food production in our country. Continued efforts in this direction are still needed to further raise the crop production to feed the fast increasing human and cattle population on this earth.

3. EVALUATION

The teacher may ask the following from the students :

- (i) What do you mean by variety of crop? Name one improved variety of wheat, maize and rice.
- (ii) How will you raise the agricultural production of the country? Name factors.
- (iii) What do you mean by soil amendments? Name amendments used for acidic and alkaline soils.
- (iv) What is acidity and alkalinity?
How will you test whether soil is acidic or alkaline?
- (v) What is the benefit of growing legumes? Name five legumes which fix nitrogen in soil.

4. REFERENCE MATERIALS

- 1. Agriculture year Book—ICAR, New Delhi.
- 2. Soil fertility—Theory and practices—ICAR, New Delhi.
- 3. Wheat research in India—ICAR, New Delhi.

CHAPTER 53

USEFUL PLANTS AND ANIMALS

1. OVERVIEW

The children are aware that the plants and animals are of great use to us. They will learn about the useful plants cultivated for food, medicines, timber etc. The children will appreciate that all the cultivated plants have come from the wild plants. Animals are also very useful to us. The chapter discusses bees, silkworm and other domestic animals their products and their role in our national economy.

2. LEARNING OUTCOME

2.1 Key terms

Albumen; Apiculture; Bark; Beshiyē; Broody hen; Candlor; Cocoon; Domestication; Cultivation; Drone; Growth rings (Annual rings); Homoeopathy; Honey; Honey bee; Honey extractor; Incubator; Infertile; Kernel; Larva; Moults; Nectar; Poultry; Pupa; Queen bee; Silk moth; Timber; Tuber; Wild; Wood; Worker bee; Yolk; Shell; Hatching; Vaccination.

2.2 Major ideas and explanatory notes

- (i) Plants and animals are either useful or harmful to us.
- (ii) Useful plants are found both in wild and cultivated forms.
- (iii) Animals are domesticated.
- (iv) Some of the plants are used for medicines and food
- (v) Some of the timber yielding plants are used for making furniture.
- (vi) Some of the plants yield edible oils.

- (vii) Animals are very useful to us. Their products are used in many ways.

Note :

The teacher may elaborate the terms with the help of the following information.

1. Homoeopathy is a type of medical practice where the medicines are prepared from plant and animal sources and are used in very diluted form to increase the defensive mechanism of the body.
2. The collection of some useful plants was thought to be expensive and time consuming. People started growing these plants according to the needs and this led to cultivation.
3. Bees sting with their sting and inject a poison which is the cause of irritation and burning sensation. Bee stings only once and if the sting gets detached from its body the bee dies after sometime. The teacher may explain that the drone are found in smaller number within a hive.
4. The bees collect nectar from the flowers which when mixed with saliva of the bees gets transformed into honey.
5. The fertilized eggs of hen hatch only when they are kept at a temperature of about 37°C . Ordinarily birds sit over the eggs and incubate for 21 days, i.e. upto the time of hatching. Whereas in incubator the eggs are kept at 37°C and proper ventilations are made for hatched chicken.
6. Green food means green leaves of the vegetables
7. The teacher may point out that hen will lay eggs whether the cock is there or not. In presence of cock the eggs will be fertilized and absence of cock will result in the laying of unfertilized eggs.
8. It may be elaborated that the larvae of the silk-moth secrete silk

thread from the silk glands present in the worm. The mulberry leaves are eaten by the silk moth. Some of the species of silk-worm feed on other plants. *Bombyx mori* is a mulberry feeding species of silk-worm.

2.3 Activities

S.No.	Title	Items required	Skills to be developed	Remarks
1	2	3	4	5
1.	To test for adulteration of honey with sugar or gur(S).	Honey, Gur, Beaker, Tumbler, Test tube, Water.	Observation, Experimental.	Teacher may help the students in comparison,
2.	To separate larvae and unhatched eggs of silk-worm(S).	Silk-worm eggs, Paper, Mulberry leaves.	Experimental, Observation.	
3.	To test the quality of an egg(S).	Pertri dish, Card-board box with a hole,	Experimental, Observation.	
4.	To collect five medicinal plants or their parts(S).	Seissors, Polythene bags, Herbarium sheets.	Collection, Preservation.	Useful information can be obtained from elders.
5.	To list about twenty plants and to draw and label their edible parts(S).	Pencil, Notebook.	Collection, Drawing.	Picturecards can be used.
6.	To list name and the place of occurrence of a five timber yielding plants(S).	Pencil, Notebook.	Identification	Growth rings can be shown by the teacher in cut stems of trees.

1	2	3	4	5
7.	To test oily nature of some seeds(S)	White paper, Coconut, Ground-nut, Castor.	Experimental Observation.	Students may do with locally available seeds.
8.	To demonstrate the parts of preserved bees like drone, worker and queen(D).	Preserved specimens.	Observation, Identification.	Preserved specimens may be used.

2.4 Relevance to daily life

This knowledge enables us to know and use various plants like Tulsi, Neem, Amla, Eucalyptus for curing many diseases. Timber and oils come from plants. The proper use of common animals and their products is a part of our daily life. The knowledge of useful organisms helps us in discriminating the harmful ones. We will be able to test the quality of the plant and animal products.

3. EVALUATION

- (i) Teacher can give a few items like cauliflower, brinjal, potato and ask students which part of the plant these items are ?
- (ii) Why honey is taken along with most Ayurvedic and Homoeopathic medicines ?
- (iii) Why mulberry leaves are important in silk industry ?
- (iv) The teacher may ask example of 5 timber yielding trees,
- (v) What makes neem and *Cinchona* very useful ?
- (vi) Can you name useful animals other than what you have studied, list a few ?

4. REFERENCE MATERIALS

1. Medicinal Plants—S.C. Datta, NCERT, New Delhi.
2. Man Made Forests S. Kondas, NCERT, New Delhi.
3. Our Tree Neighbours—C S. Venkatesh, NCERT, New Delhi.
4. Medicinal Plants—S.K. Jain, National Book Trust, New Delhi.
5. Glossary of Indian Medicinal Plants—R.N. Chopra and others, CSIR, New Delhi.
6. Timber its structure and properties—H.E. Desh Mac-millan and Company, New Delhi.
7. Animal Husbandry—Chapter on Bee keeping, ICAR, New Delhi.

CHAPTER 54

ANIMAL HUSBANDRY

1. OVERVIEW

In the previous chapter children have studied the useful plants and animals. They have also learnt the scientific management of crops. It becomes essential and is useful to know different types of animals-milch, wool and meat giving and their management. The Children observe that some animals are employed for agricultural operations and transport. The knowledge of animals and their management is very important in order to have their product as well as their proper use.

2. LEARNING OUTCOME

2.1 Key terms

Domestication; Transportation; Veterinary, Animal husbandry; Weeding; Dairy herds; Draught breeds; Dual purpose breed; Bran; Alfa alfa; Clover; Balanced food; Bedding; Milking; Udder, Stuffed; Hygienic; Parasite; Ectoparasite; Endoparasite; Diagnosis; Foot and mouth disease; Contagious; Soreness; Saliva; Segregated; Vaccine; Flocks; Hay racks; Shearing; Dipping; DDT; Cashmilon; Nylon; Pneumonia; Lesion; Piggery; Alimentary canal, Diamond disease; Breed; Artificial insemination; Semen bank; Dry land.

2.2 Major ideas and explanatory notes

- (i) The animals are kept for specific purposes. Each domestic animal has its needs of food, shelter and health care.

- (ii) Different breeds of different animals are used for different purposes.
- (iii) All useful animals also get diseased and need proper treatment.
- (iv) The quality of products from these animals can be improved through breeding.

Notes :

The teacher may use the information given below for explaining certain terms and ideas.

1. **Breed:** Type of animal having specific genetic characters which are passed on to their successive generations. The characters are high yield of milk and resistance to diseases.
2. Hay is artificially preserved chaffed fodder.
3. Contagious diseases spread through contact.
4. Balanced food here means nutritionally balanced.
5. Causal organisms for foot and mouth disease and diamond disease are bacteria and virus respectively.

2.3 Activities

S. No.	Title	Items required	Skills to be developed	Remarks
1	2	3	4	5
1.	To test the amount of water in the milk (S).	Milk, Water, Glass tumblers, Test tubes.	Experimental, Test Observation	This is approximate testing more of a qualitative nature.

1	2	3	4	5
2.	To study different types of fibres S).	Silk, Cotton, Polyester, Wool, Watch glass, Magnifying lens, Microscope, Glass slide, Needle.	Observation, Use of microscope.	Students may be asked to draw their observations made with microscope.
3.	To prepare the list of all domesticated animals with purpose of domestication of each in the locality(S).	Pencil, Notebook.	Observation, Collection of information.	The teacher should encourage the students for getting information from elders.
4.	To record kinds of animals, their breeds, average yield of milk of in each case during visit to dairy farm(S).	Pencil, Notebook.	Collection of information.	Students may collect information from elders. A visit to nearby dairy farm may be arranged.
5.	To observe common diseased animals to know symptoms of each(S).	Pencil, Notebook.	Observation, Identification.	Information may be collected with the help of elders.

2.4 Relevance to daily life

The relationship of different animals with human beings is inseparable. It is imperative for us to know the ways the animals may be utilized and in turn the best management of these animals for making them more useful to mankind. The children will appreciate that the knowledge of animals and their problems which we come across everyday helps in better maintenance of these animals.

3. EVALUATION

The teacher may ask students the following questions ;

- (i) What are the uses of dairy, draught and dual purpose breeds? Give one example in each case.
- (ii) Why we prefer legumes or pulses in cattle food?
- (iii) Why cattle shed should be away from human habitation?
- (iv) Why stuffed calves are used by milkmen to milk their cows or buffalo?
- (v) Name some milk products. How will we test the approximate amount of water in the milk?
- (vi) Name two disease causing organisms of common diseases of our domestic animals.
- (vii) What are the terms shearing and dipping in sheep rearing?
- (viii) Why pigs are fed with fibrous food unlike cattle? The expected answer is very small alimentary canal.
- (ix) Give the symptoms of foot and mouth disease in cattle and diamond disease in pigs.

4. REFERENCE MATERIALS

1. Domestic Animals—Harbans Singh, National Book Trust, New Delhi.
2. Feeding of dairy cattle and Buffaloes—S P. Arora, Technical Bulletin, ICAR, New Delhi.
3. Handbook of Animal Husbandry—ICAR, New Delhi.
4. Biology, A textbook for Higher Secondary Schools, Class XII, Part II, vol II—NCERT, New Delhi.

CHAPTER 55

CONSERVATION OF NATURAL RESOURCES

1. OVERVIEW

The children have basic idea of living and non-living objects. In this chapter they will know more about these as resources. These resources are used to maintain our life and to spread civilization. The children will learn that the resources are either renewable or non-renewable, and a wise use is necessary to keep balance in nature. The chapter mentions that all the components of the resources are inter-linked and depletion of one will affect the other.

All the resources are not inexhaustible. Some of the resources will be finished within a few years if they are overused. The judicious and wise management of forests and wild life, i.e. conservation is very important from the stand point of natural resources.

2. LEARNING OUTCOME

2.1 Key terms

Conservation; Fossil fuel; Natural resources; Renewable resource; Non-renewable resource; Water table; Wild life; Wind breaker; Terracing; Percolation; Sand binder; Sanctuary.

2.2 Major ideas and explanatory notes

- (i) Earth has different types of resources.
- (ii) Resources may be renewable or non-renewable.
- (iii) The resources are exhaustible.
- (iv) Both plants and animals are also natural resources.
- (v) Wise use and management of these resources is necessary.

Notes :

1. Petrol, coal etc. are the fossil fuels. These were formed by plants and animals which got buried under soil and were subjected to various chemical changes. These can be renewed through various cycles of nature.
2. Top soil is the upper most surface layer of the earth. It generally supports plant roots. It is removed by water and wind thus affecting the moisture of lower layers.
3. The roots of the sand binders help in sand binding by retaining moisture for longer time and they are generally insect and other pest resistant. For example roots of *Sarkanda* are not attacked by rodents.
4. Van mahotsava was introduced in 1950 by Sh. K.M. Munsli, the then Union Minister for Agriculture. It is celebrated every year by planting a large number of trees. The mention may also be made of other such movements like Chipko and the World Wild - Life Fund working for the proper management of wild life and environment.

2.3 Activities

S No.	Title	Items required	Skills to be developed	Remarks
1	2	3	4	5
1.	To collect and observe water samples from different sources (S).	Specimen bottles, Hand lens, Glass slide, Microscope.	Collection, Observation.	Different sources for sampling may be tap, drains, pond, river etc.

1	2	3	4	5
2.	To study soil erosion due to water (S).	Two trays, Beakers, Soil.	Experimental, Observation.	
3.	To study wind erosion of soil (S).	Sand, Table fan, Hand lens.	Experimental, Observation.	
4.	To study the role of terraces in checking soil erosion (S).	Mud, Khurpi, Water.	Observation.	It may be done outside in the lawn.
5.	To collect paper cuttings and pictures on conservation (S).	Newspapers, Magazines.	Collection, Identification.	

2.4 Relevance to daily life

The knowledge gained in the chapter helps us to appreciate the need to conserve plants and animals. In order to keep environment healthy overuse of natural resources must be avoided. It may lead to extinction of certain species. For example the felling of forest trees has led to decrease in population of animals like tiger, cheetah and the great indian bustard. Wise and judicious use of water, fuels and other natural resources is desired which helps in use of these resources over a longer period.

3. EVALUATION

- (i) Why do people prefer to walk on grassy areas during rains?
- (ii) Why do we cement the foot paths in cities and towns?
- (iii) Why sand dunes are seen more in deserts and sea side areas?
- (iv) Why green belts are kept as reserves in the crowded cities or colonies?
- (v) What will happen if all the coal, oil and other resources are completely used up? How can we prevent this?

4. REFERENCE MATERIALS

1. Science, A textbook for Secondary Schools, Class X, Part I
--NCERT, New Delhi, Unit on Man and His Environment.
2. Biology, A textbook for Higher Secondary Schools, Class XI,
Part I--NCERT, New Delhi, Unit on Man and environment.
3. Science Reporter--A monthly magazine CSIR, New Delhi.
4. Science Today - A monthly magazine, Bombay.
5. School Science--A quarterly Journal, NCERT, New Delhi
6. Newspaper reports, Radio and TV programmes.

CHAPTER 56

SCIENTIFIC METHODS

1. OVERVIEW

The children have learnt many scientific principles in their previous classes. They will appreciate there are similarities in the methods of science and in the methods of our daily life. In both the situations careful observation, formulation of proper hypothesis, collection of data and drawing of inference are important components. Several examples from science and daily life situations are given to present this idea.

It is hoped that experience of all the previous chapters will be utilised to strengthen this point. The understanding of this lesson is expected to help the child in following the methods of science in daily life activities.

2. LEARNING OUTCOME

2.1 Key terms

Observation; Problem; Hypothesis; Experiment; Data collection; Control experiment; Analysis; Inference; Theory; Inquisitiveness; Open mindedness.

2.2 Major ideas and explanatory notes

- (i) Each generation of mankind is working in the foundations of experiences gained by its ancestors.
- (ii) Methods adapted by the scientists are same.
- (iii) Methods of science and methods employed in our daily life activities are similar.

Notes :

1. The paragraphs 3.1 & 3.2 include the content to develop this principle.
2. Charts of primitive men and of different tools used by them may be used while developing the theme.
3. While dealing with the examples given in this chapter, teacher may also select examples from earlier chapters.
4. From the examples of Malaria, Flying machine, Printing and time measurement, the similarity of methods adopted should be highlighted. The teacher may select more examples to stress the point.
5. It is necessary to see that students are able to understand the following abstracts in the scientific methods: Hypothesis, problem, experiment, Control, Data, Inference.
6. While dealing with the section 3.3, examples from various daily life situations may be given. For each situation, ultimate result may be indicated and students may be asked to find out the cause of the result. The purpose is to show the relationship between the methods and results of action taken in daily life situation. Common examples may be used to illustrate.
 - (i) What is most important in decision making,
 - (ii) How the short term benefit of a decision may create disadvantage in the long run and
 - (iii) What are the factors which force us to take a wrong decision?

2.3 Activities

The activities for teaching this chapter should be selected to develop decision making abilities of the child. For this purpose, the teacher may select activities from the earlier chapters. In each activity the teacher should

presume several alternates, so that on the basis of proper evidence the students can select the right step.

The following activities may be suitable.

1. Devising an appropriate method for controlling mosquito and house fly.
2. Selection of right kind of seed for the school garden.
3. Different actions to be taken for growing rose plants.
4. Preparation of soil for developing a kitchen garden.

It is not necessary that all these activities are to be done. One or two activities may be selected. For each step, teacher may prepare several alternate actions in advance. Let students discuss and decide the correct one. If some student selects the wrong answer let him/her test it and find out why things have gone wrong.

Teacher may prepare in advance a list of habits which prevail in the community e.g., Food habit, cleanliness, social habits. Let students explain how far each one is scientifically correct. If they think that a particular habit is wrong, let them suggest the right one and to state the reasons for such inference.

2.4 Relevance to daily life

Science and technology have not percolated to the most of the people of our country. In spite of tremendous development in food production, health and sanitation, majority are without the benefit of all these developments. Such group of people (who are the majority) have a feeling that science education has no meaning for them.

The importance of this chapter is to show the most important aspect of science i.e., its method is in no way different from the methods of daily life. In the case of science, if the methods are not properly followed, the results will be erroneous. In daily life activities also if these methods are followed the consequence will not be disastrous. The essential requirements for both the method of science and methods of daily life are interest, curiosity, courage, the habit to ask questions on things which are not understood and of

collecting and analysing data for making an inference. The individuals with such qualities work collectively and co-operatively. All these qualities develop through training and then an individual can contribute effectively in daily life situations and also in the pursuit of science.

3. EVALUATION

- (i) Instead of attempting to test the students, the teacher should observe whether they are practising scientific method in daily life situation or not.
- (ii) The situations are to be created to observe the students power of observation, interest, curiosity, ability to collect data, to infer and to work collectively and co-operatively.

4. REFERENCE MATERIALS

1. Science and Society—A Supplementary reader for Secondary Schools—NCERT, New Delhi.

CHAPTER 37

SCIENCE IN HUMAN WELFARE

1. OVERVIEW

Human welfare is fully based on the growth and development of science. It has helped in solving our basic problems—food, health and shelter. We are looking forward to science for further help. A number of problems being faced by mankind, at present, are said to be due to science itself. How far is this true? A careful analysis reveals that innumerable problems were created by the wrong decisions of man. The most important contribution of science is not the material benefits but a set of processes which one can use for solving daily life problems.

2. LEARNING OUTCOME

2.1 Key terms

Method of Science; Scientific thinking; Decision making; Technology.

2.2 Major ideas and explanatory notes

- (i) Science has helped us to solve our basic problems in many ways.
- (ii) In spite of the contribution of science, basic problems are not yet solved.
- (iii) Misuse of science results into a number of problems.
- (iv) Decision making plays most important role in day to day activities.
- (v) The knowledge of methods of science helps in taking wise and just decisions.

Notes :

1. Instead of giving lecture, teacher may offer learning experiences to the class in the form of pictures, charts and newspaper cuttings.
2. Students may be allowed to discuss each major idea and to come to an inference (Inference does not mean that every body will have to come to the same conclusion. Students may be allowed to differ only if they have sufficient evidences in favour of the argument).
3. It is necessary for the teacher to ensure that all students realize the importance of proper decision making ability.
4. The points should be well illustrated with examples from daily life experience and the previous chapters.

2.3 Activities

S. No.	Title	Items required	Skills to be developed	Remarks
1	2	3	4	5
1.	To list the different contributions of science which gives us rice and chapati(S).	Pencil, Notebook.	Observation, Collection of data, Curiosity.	
2.	To list the different institutions of our country concerned with food production. Plot these institutions in the map of India(S).	Map, Pencil, Notebook.	Observation, Collection of data, Curiosity.	

1	2	3	4	5
3.	To list the preventive measures of common diseases(S).	Pencil, Notebook.	Observation, Collection of data, Attitude.	Examples of diseases may be Cholera, Small pox, Malaria, Whooping cough, Scabies, Tuberculosis, Eye-infection, Infection of worms.
4.	To list the domestic items which are the contribution of science. Find out the time rays of their introduction and note the changes(S).	Pencil, Notebook.	Observation, Collection, Analysis, Synthesis of data.	Section 3.1 of textbook be referred.

2.4 Relevance to daily life

Those who do not enjoy the fruits of science feel that there is no need for learning science. At the sametime problems created by science often cause a feeling of rejectment. These attitudes are the results of misunderstanding about the nature of science. Everyday we take decisions for doing various works. The undesirable results crop up when decision is faulty. This is also true for all actions where science is involved.

For this reason, it is necessary to employ the methods of science in each and every decision making. The best service of science to the welfare of human beings is not the material benefits but the offering of a well tested method, which is applicable to daily life situations.

3. EVALUATION

- (i) Do you agree with the statement—"Development of science has caused pollution of the environment"? Give reasons to your answer?
- (ii) Write the beneficial and harmful aspects of following scientific studies.
 - a. Nuclear physics
 - b. Bacteriology
 - c. Genetic engineering
 - d. Food technology
- (iii) What are the different applications of technology available in your environment? How do you think that knowledge of science may help in its further improvement?

4. REFERENCE MATERIALS

1. Biology, A textbook for Higher Secondary Schools, Classes XI—XII, Part I—II—NCERT, New Delhi.
2. Biology—Ed. Maheshwari and Lal, NCERT, New Delhi.
3. Biology, A textbook for Classes IX,X,XI, Study group versions—NCERT, New Delhi.

Appendix I

It is felt necessary that the curriculum users must be aware of its aims, objectives and philosophy. This introductory information was not available to the classroom teachers during the initial stages of implementation of Integrated Science Curriculum. The teachers should for further details consult the document titled : Integrated Science Curriculum for Middle Schools (Classes VI-VIII) —An Introduction brought out by Department of Education in Science and Mathematics, NCERT, New Delhi. Some of the salient features of this curriculum reproduced from the above document and some other points are given below :—

The integrated science curriculum was developed by the Department of Education in Science and Mathematics, NCERT in collaboration with scientists, educators and classroom teachers. Salient features of the course are briefly mentioned here.

General Objectives :

- To emphasise the relevance of science to daily life
- To develop scientific attitudes
- To create an environment conducive to greater reliance on the use of principles and practice of science.
- to acquaint the pupils with various natural phenomena
- To emphasise the experimental nature of science
- To emphasise the unity of methods of different disciplines of science.

Nature of the course :

A survey of different curricula for this age group, developed on the basis of integrated approach, shows that there exist different levels of integration. While developing this course, the group considered the constraints prevailing in our country, limited resources of the schools, limitation of the teachers, abilities of children and their social background and traditions of science teaching.

In order to have a smooth transition a drastic change was avoided. It was felt that while developing a course with an integrated approach, it would be better to restrict to the elementary level of integration.

Efforts have been made to integrate science with the environment of the child rather than presenting an artificial integration of disciplines. The children with the background of science at primary level should find this course as a continuation of their earlier knowledge. At the same time they may be mentally equipped to take up the existing science courses at the secondary level. The pupils, whatever may be their future training or profession, would be able to participate in their day-to-day activities more effectively without necessarily identifying themselves as physicists, chemists, or biologists. They would go about their jobs as persons acquainted with science and the fundamental unity of scientific principles operating in the environment.

While working with this course a resourceful teacher would find it easy to develop among the children a better understanding of this fundamental unity of science.

Target Group :

The course is meant for the mixed ability teaching of children in the age group of 11-14. It is expected that children will find the course useful for understanding the animate and inanimate nature in their surroundings. It will enable them to live effectively in their environment as enlightened citizens. This course will also be useful to provide them with a strong base for further studies.

Time Requirement :

Seven periods per week of 210 school periods per year, (taking a school period to be of 30/35 minutes duration) are considered adequate for covering the course.

Materials Required :

It would be possible to do most of the activities with locally available

materials. The disciplinewise science kits developed by NCERT, already in use in middle school classes will be useful in teaching of this course. Schools may also use the newly devised Composite Integrated Science Kit. They may improvise/procure models and other items suggested in the kit manual.

Presentation of Topics :

In order to avoid complete diversion from the existing disciplinewise curriculum, the topics included in the course retain their disciplinewise character. These have been selected as important components of environment and not merely as topics of physics, chemistry and biology. By reading the subject matter in the textbook, a teacher who has already a subject bias may easily identify the discipline on which the particular unit is based. Such a presentation denotes the primary level of integration recommended by educators all over the world.

The textbook contains chapters almost corresponding to the units mentioned in the syllabus. The framework within which the textbooks have been written are based on the objectives mentioned earlier.

Each chapter is divided into following sections :—

- i. Observations
- ii. Questions
- iii. Let us find out
- iv. What have we learnt and how is it relevant ?

Observations :

In this section each chapter includes a number of observations, sometimes along with simple and obvious deductions from daily life experiences of the child. This motivates them to recall other examples. In fact, the technique of such a recall has been widely used throughout the chapter. Sometimes it also contains certain other facts and obvious conclusions within the comprehension of children of the middle school classes. This section leads to interesting questions and answers.

Questions :

Some of the questions included are those which might occur in the minds of most of the children. These follow logically and naturally from the observations presented. There would, of course be many other questions the children would ask. No attempt has been made to be exhaustive. Questions are raised in other sections as well, but in the more limited context. These questions are not to be confused with evaluation tests or substitute of exercises usually found at the end of chapters.

Let us find out

It is not intended to merely give answers to the questions posed in the previous section, even though all the questions raised have been answered somewhere or the other in this section. Alternatively enough information has been provided for the child to arrive at the answer by himself. There is no strict 1 : 1 correspondence between the question and the "Let us find out" sections since new information, often arising as corollaries to the main questions, is also given.

This section also includes interesting activities which the pupils may do either in the school or at their homes. It must not be considered obligatory for them to carry out all activities. They should do whatever is possible for them. These practical exercises are designed to make the pupils think as well to provide them with some skills and consolidate their knowledge. The activities would not need anything that will not be available in an average rural situation.

What have we learnt and how is it relevant? :

It is not just a summary of what has been brought forth earlier. It attempts to establish the true significance of what children have learnt to the experiences in everyday life.

The textbooks are designed to impart conceptual clarity, skills and a certain set of values to the pupil, rather than providing them with factual knowledge or information alone. A great deal of information in the book especially the one given in the charts and tables is not meant to be memorised by the students.

Expected Learning Outcome :

Learning outcome is the sum total of what the child will learn. The present integrated science course has been developed to fulfil the general objectives mentioned earlier. While teaching it is necessary to ascertain that objectives of all the three domains; cognitive, psychomotor and affective are fulfilled. The emphasis on the fulfilment of cognitive objectives makes the curriculum heavy and both teachers and students devote major time in dealing with facts, figures, data and other details. But is it possible for the child to remember all the facts for the rest of the life. For this reason while teaching the course the teacher should ensure that after teaching the child will—

- be interested in science
- realise the relationship of science with the things and occurrences in the environment.
- become curious
- develop the habit of collecting data and analysing it before making an inference on all daily life situations
- develop the habit of not accepting things as inevitable or destiny
- gain evidence to ask questions on things and occurrences which he or she does not understand.

Appendix II

Addresses of various organizations bringing out the popular as well as technical reading materials on science, agriculture and medicine are given below. These find a mention in the section : Reference Materials in this teacher's guide. The teachers should contact the concerned institution for getting the publications which are low priced.

S. No.	Source	Remarks
1.	National Book Trust (NBT), A-5 Green Park, Sri Aurobindo Marg, New Delhi-110016.	Popular Science books-
2.	Council of Scientific and Industrial Research (CSIR), Pusa Marg, New Delhi-110001	Science Reporter Vigyan Pragati
3.	Indian Council of Agricultural Research (ICAR), Krishi Bhawan, New Delhi-110002.	Information booklets, Bulletins and Reports
4.	Extension Directorate, Ministry of Agriculture and Food, Krishi- Bhawan, New Delhi-110002.	Information book- lets, Bulletins, Reports and magazines like Kheti and Farming.
5.	Indian Council of Medical Research (ICMR), Ansari Nagar, Ring Road, New Delhi	Information book- lets
6.	Times of India Building Dr. R.N. Road, Bombay-400001.	Science Today
7.	Fertiliser Association of India, New Mehrauli Road, New Delhi	Newsletter and information book- lets

Appendix III

Below are given some teaching aids (16 mm and 35 mm films) available in the Central film library of The Department of Teaching Aids, (NCERT), 17-B Indraprastha Estate, New Delhi-110002.

<i>S. No.</i>	<i>Name of the Film</i>
1.	Atom and Agriculture
2.	Atomic Theory
3.	Basic Fibres in Cloth Materials
4.	Clothing
5.	Characteristics of Liquids
6.	Characteristics of Gases
7.	Characteristics of Solids
8.	Chemistry and changing World
9.	Chemistry of Food
10.	Chemistry of Combustion
11.	Conservation of Natural Resources
12.	Cotton and fibres to fibres
13.	Clay
14.	Sensitivity
15.	Electrons
16.	Environmental Sanitation
17.	Erosion
18.	Forest Conservation
19.	Importance of Pure Water
20.	Oxygen
21.	Our Common Fuels
22.	The manufacture of Plastics

23. Preface to Chemistry
24. Soil and Water Conservation
25. Steel, Steel for progress, Story of steel
26. Water
27. Acids, Bases and Salts
28. Adventuring in Conservation
29. Black Gold
30. Cotton Processing
31. Electrons and Atomic Structure
32. Oxygen in nature and its uses
33. Properties of Water
34. Rocks and Gems
35. Sun and how it affects us
36. What is Science ?
37. Wonders of Water

**Workshop to develop Teacher's Guide based on the textbooks
Learning Science for Classes VI-VIII held at
D.E.S.M., N.C.E.R.T., New Delhi**

List of Participants

- | | |
|---|---|
| 1. Sri S.C. Sharma,
Science Branch,
3, Link Road, Karol Bagh,
New Delhi-110005. | 8. Mrs. Sunita Bajaj,
Adarsh Public School,
BF-37 Tagore Garden,
New Delhi. |
| 2. Sri Sohan Singh,
Saraswati Bal Mandir,
Hr. Sec. School,
Hari Nagar, L-Block,
New Delhi-110018. | 9. Sri Bushan Lal Majoo,
Teacher, Govt. High School,
R.N. Mandir, Srinagar,
Kashmir. |
| 3. Miss. R. Usha Gowri,
The Mother's International
School,
Sri Aurobindo Marg,
New Delhi-110016. | 10. Sri Upendra, Razdan,
Teacher, Govt. High School,
R.N. Mandir, Srinagar,
Kashmir. |
| 4. Dr. V. Kaushal,
Deptt. of Physics,
Delhi College of Engg.,
Delhi-110006. | 11. Mrs. Kusum Bansal,
Kendriya Vidyalaya,
I.I.T. Campus,
New Delhi-110029. |
| 5. Sri R.S. Arora,
Sc. Branch, 3, Link Road,
Karol Bagh, New Delhi-5

Dr. D.P. Mittal,
Sc. Branch, 3, Link Road,
Karol Bagh, New Delhi-5. | 12. Miss. Meena Sharma,
Sardar Patel Vidyalaya,
Lodi Estate,
New Delhi-110003. |
| 7. Dr. Nitishranjan Das,
Deptt. of Zoology,
Serampore College,
Serampore, Hooghly,
West Bengal-712201. | 13. Mrs. Satyawati Sharma,
T.G.T., D.M.P.H.S. School,
Regional College of Education
Ajmer (Rajasthan). |

Resource Persons

1. Dr. A.R. Ansari,
Department of Physics,
Jamia Millia Islamia,
New Delhi
 2. Dr. K.N. Singh,
Senior Scientist,
Division of Agronomy,
Indian Agricultural
Research Institute,
New Delhi-110012.
 3. Dr. S. Chatterjee
School of Life Sciences,
Jawahar Lal Nehru University,
New Delhi-110067.
 4. Shri N.D. Panday,
Principal,
Kendriya Vidyalaya,
Pratap Nagar,
Udaipur, Rajasthan.
 5. Prof. B. Ganguly,
Department of Education in
Science & Mathematics,
N.C.E.R.T.,
New Delhi-110016.
 6. Shri K.J. Khurana,
Department of Education in
Science & Mathematics,
N.C.E.R.T.,
New Delhi-110016.
 7. Dr. K.M. Pant,
Department of Education in
Science & Mathematics,
N.C.E.R.T.,
New Delhi-110016.
 8. Dr. R.P. Bhatia,
Department of Education in
Science & Mathematics,
N.C.E.R.T.,
New Delhi-110016.
- Co-ordinator**
9. Dr. J.S. Gill,
Department of Education in
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N.C.E.R.T.,
New Delhi-110016.

**Workshop to Finalize Teacher's Guide based on
textbooks Learning Science for Classes VI-VIII
held at D.E.S.M., N.C.E.R.T., New Delhi**

List of Participants

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|---|--|
| 1. Shri D.K. Gupta,
PGT (Agri.)
Govt. Co-educational Teacher
Training Institute,
Darya Ganj,
New Delhi-110002. | 5. Shri Arvind Sharma
Ramjas School,
R.K. Puram, Sector-4,
New Delhi. |
| 2. Shri S.C. Sharma,
Science Branch,
3-Link Food
Karol Bagh,
New Delhi | 6. Dr. B.L. Arora,
Department of Physics,
ARSD College,
Dhaura Kaun
New Delhi. |
| 3. Shri S.K. Mudgil,
Govt. Model, H.S. School,
Civil Lines, Delhi. | 7. Shri B L. Arora,
Delhi Administration,
Delhi |
| 4. Shri S.C. Das
State Institute of Science
Education,
PSM College Campus
Jabalpur. M.P. | 8. Miss. B D. Souza,
Kendriya Vidyalaya,
Delhi Cantt.
New Delhi. |